THE

INDIAN FORESTER;

A MONTHLY MAGAZINE

OF

FORESTRY,

AGRICULTURE, SHIKAR & TRAVEL.

EDITED BY

J. S. GAMBLE, M. A., F. L. S.,

CONSERVATOR OF FORESTS, AND DIRECTOR OF THE
FOREST SCHOOL, DEHRA DUN.

VOL. XX, 1894.

MUSSOORIE.
PRINTED BY THE MAFASILITE PRINTING WORKS
COMPANY, "LIMITED."

1894.

Index, 1894.

VOL. XX.

I.—ORIGINAL ARTICLES AND TRANSLATIONS. *Page.*

A handsome new Burmese Bamboo, with Frontispiece ... 1
A Tour in Jaunsar, No. 7. (*conclusion.*) 2
Recruits for the Forest Department 10,85
Forest Administration in Oudh, by O. C. 13
Another effect of the influence of climate on Forest vegetation —by Mian Moti Singh 16
Utilization of the less valuable trees, by Sir D. Brandis, K. C. I. E. 38
The Hill Forests of Java translated by S. E.-W. 55,87,121
Protected Forests, by G. E. M. 57
Mixed Forests of deodar and blue pine, by Mian Moti Singh ... 92
The French Forest Department in Algeria 95
Note on experiments on Charcoal, by M. R. 98
Seeding of *Srobilanthes* in the Nilgiris. by R. M. ... 130
Forest Offences, by Kassau 130
Influence of the removal of humus on the vegetation of Forests 135
Alluvion and Diluvion, by B. H. B.-P 168
Utilization of the less valuable Trees, by Col. Campbell-Walker 172
Damage done to Himalayan Pines by Loranthaceous parasites... 177
Albizzia lophantha as a 'reboisement' plant 178
Vallombrosa and the Royal Italian Forest School, by A. C. ... 207
The Herikalgudda Forest, by N. Narayen Rao ... 213
The Hill Forests of Bashahr, by Mian Moti Singh ... 216
Note on the occasional formation of pseudo-autumnal zones of wood, by J. Nisbet 221
The Gutta-percha industry, translation by A. F. G. ... 225
Notes on the Tour of the Forest School students in the Western Dún and Saharanpur Siwaliks, in 1894, by H. G. Billson 244
Insect Pests in the Goalpara District, by T. J. Campbell ... 256
Yield of Katha, by E. E. Fernandez 258
A Note on the propagation of Blackwood or Rosewood (*Dalbergia latifolia*) in Java, by S. H. Koorders ... 282
Failure of Natural Reproduction in the teak forests of the Coimbatore District, by H. J. Porter 285
The Cure of Snake-bite, by C. W. Hope 288
The Preference of Lightning (translated from the Revue des Eaux et Forêts, by A. F. G.) 291
Tannin in Indian Oak Barks, by D. Hooper ... 293
A Note on Sandalwood, by S. H. Koorders, Conservator of Forests in Java, translated by S. E.-W 321
East Indian Walnut 324
The Malabar Steam Saw-mills, by "R. M." 325
On Extending the Culture of Silver Fir in France, translated by A. F. G. 326

The Prize-day at Coopers Hill 328
Notes on the use of Simul wood for tea boxes in Assam, by A. Smythies; with note by Hon. Editor, and Extract from a letter from Mr. Fordyce, Andamans Forest Department 362
The influence of Places on the spirits, by 'Rahdari' ... 367
Forestry and Sylviculture, a lecture by D. E. Hutchins, delivered in Capetown 368
Recruits for the Upper Controlling Staff of the Forest Department 406
Punishments for Cattle Trespass, by 'O. C.' 410
Modification of French Forest Law as regards the power to give light sentences in the case of forest offences ... 411
A visit to the Culbin Sands, Morayshire, Scotland, by E. Mc. A. Moir 444
Disease of Cocoanut Trees in Travancore, by E. Stebbing ... 450
Obituary, M Corbett 451

II. —CORRESPONDENCE.

Publication of Forest Statistics, a letter from 'G. E. M.' ... 18
Forest Administration in the C. P., a letter from 'Tau tha.' 18
'Border' on Esprit de Corps, letter from 'Velleda' ... 20
Tour in Jaunsar, letter from E. McA. M. 60
Recruits for the Forest Department 62
A New Himalayan Beverage, letter from G. G. Minniken 62
Iron-making in South India, letter from H. Warth, with extract 100
The law of property in case of erosion, letter from "P. and P." 136
Age of Indian Forest trees, letter from A. W. Lushington ... 138
Percentage of higher forest appointments in Bombay, letter from 'Critic' 138
Reduction of the Imperial Forest Service, letter from 'Na-Ummed' 139
Pension Rules of Forest Officers, letter from 'F. O B., ... 140
Resolution in Systematic Fire-protection of Forests, letter from 'Jo-hukam' 178
The Grading of Rangers, letter from C. E. Muriel ... 179
Reduction of the Imperial Forest Service, letter from Mr. B. Ribbentrop 227
Pension Rules of Forest Officers, letter from J. W. C. ... 227
Legal position of Water-areas inside Reserved Forests; letter from "Q" 259
Iron making by means of gas-furnaces; letter from Dr. H. Warth 259
Age of of production of good seed, letter from "Seed" ... 261
Promotion in the Bombay Forest Department, letter from 'Bombay Officer' 261
The Forest Department in Madras, letter from "Madrassee" 294
Promotion in the Bombay Forest Department, letters from 'Nancéien,' 'Eclaireur' and 'Nancy' ... 295
Disease of Cocoanut trees in Travancore, letter from A. M. Sawyer 330

The Strongest Timber, letter from W. J. Lane-Ryan ... 331
Denudation of Nilgiri Slopes, letter from "R. M." ... 331
Flowerwing of Bamboo in Coimbatore, letter from H. B. Bryant 332
Collection of Hirda Fruit in Satara, letter from R. S. Fagan... 332
Block in Promotion, letter from 'A. J. C.' ... 333
Water Areas in Reserved Forests, letter from 'B. H. B-P.' 380
A Cure for Snake-bite, letter from 'O. C.' 381
White-ants and Mr. Cotes' Manual, letter from 'R. C. W.' ... 382
The Strongest Timber, letter from S. H. Koorders ... 383
Value of "Pynkado' for Sleepers and paving-blocks, letter from W. A. Talbot 413
Albizzia lophantha at the Cape, letter from D. E. Hutchins ... 413
The Malabar Steam Saw-mills, letter from R. M. ... 451
Pyingado for Wood-pavement, letter from J. Nisbet ... 452
New Pension Rules for Forest Officers, letter from "Fides servanda est" 452c
Germination of "Kharshu," letter from F. A. Leete ... 453
Flowering of a Bamboo in S. Canara, letter from R. Morgan ... 453

III.—OFFICIAL PAPERS AND INTELLIGENCE.

Reorganization of the Executive Staff 21
Note on the Pests of the Teak Tree, by Major C. T. Bingham 22
Usar Reserves at Cawnpore and Aligarh 63
The Campbell-Walker Prize for Forestry at the Dehra Dun Forest School 66
Revised Rules for the entry of Native Non-Commissioned Officers into the Forest Department 67
Remission of Forest Revenue to Treasury through the Post Office 69
Review of Forest Administration in British India for 1991-92. 103
Tasar Silk production in the Central Provinces 110
Note on the extraction of Agave Americana fibre at Coimbatore 140
Riding Instruction for Dehra Dun students 142
The Moreau pattern Charcoal Kiln 143
Notes on Forest tram-lines and wire lines in Germany and Switzerland, by H L Porter 180
Rules for the training of Junior Assistant Conservators in Madras 184
Grass Farming in Coimbatore 226
Poona College of Science Calendar for 1894 234
Experiments on the calorific power of woods 262
Re-issue of the "Annales Forestières" or "Revue des Eaux et Forêts" 264
Re-issue of Annales Forestières 298
Is the Removal of Drift Timber a Forest Offence ? ... 298
Budget Estimates of the Forest Department for 1892-93. ... 334
Statistics of Trade in Forest Produce in 1892-93. ... 335
Forest Policy in Bombay 336
Imperial Forest School Report for 1892-93. 383
Allowances of Working Plans Officers 384
Resolution on the Forest Policy of the Government of India 414
Enquiries regarding Indian Trees 454

IV.—Reviews.

Reports on Botanical Gardens 25
The Cape Forest Report for 1892 26
Forest Inspection Reports on the Districts of Salem, North Coimbatore, Anantapur, Bellary and Vizagapatam ... 69
British Forest Trees 72
Agriculture in Cuttack 112
Annual Progress Report on the State Forest Administration in New South Wales for 1892 115
Bengal Statistics 116
The Dacca District in Bengal 116
The Protection of Woodlands, by Dr. J. Nisbet ... 149
Annual Agricultural Report of Bengal for 1892-93 ... 150
Progress Report of Forest Conservancy in Ceylon for 1892 .. 151
Forest Administration in Jodhpur for 1892-93 .. 154
Mineral production in India for 1892 154
Indian Railways Report for 1892-93 155
'Le traitement des bois en France,' Review by W. R. Fisher 187
The Annual Forest Administration Report for Madras for 1892-93. 190
The 'Timber Trades Journal,' Special issue, No. 19 ... 190
Indian Museum Notes, Vol. III. No. 3 236
An American Working Plan 238
New Works by B. H. Baden-Powell, C. I. E. on Forest Law and on Land Revenue Systems 266
Report of the Agricultural Chemist to the Government of India for 1892-93. 269
Forest Administration Report for 1892-93 for Ajmere, Berar and Baluchistan 301
Studies in Forestry, by Dr. J. Nisbet 307
Field and Garden Crops, by J. F. Duthie 308
A Bombay Forest Flora 344
Annual Forest Administration Reports, for 1892-93, for Assam, the North-Western Provinces and Oudh, and the Forest Surveys 345
Report on Forest Administration in the Jeypore State for 1893 351
Report on the Botanical and Afforestation Department, Hong-Kong, for 1893. 352
Report on Canal Plantations, North-Western Provinces, for 1892-93. 352
Report on Arboriculture, North-Western Provinces and Oudh, for 1892-93. 353
Annual Forest Administration Reports, for 1892-93, for Bombay and Burma 385
Annual Administration Report of the Agricultural Department, Central Provinces, for 1892-93. ... 396
Administration Reports of the Madras Government Museum, Nilgiri Parks and Gardens, 1893-94. ... 398
Annual Forest Administration Report for 1892-93 for Bengal the Punjab and Coorg 428
Durability of Wooden Sleepers 423
The Forests of Travancore 458
Reports on the Gardens at Saharanpore and Lucknow for 1893-94. 470

V.—SHIKAR ETC.

Athletic Sports of the Imperial Forest School 480

VI.—EXTRACTS, NOTES AND QUERIES.

In the Amador Second-growth Forest 30
The Chicago Exhibition, from the 'Forst und Jagd Zeitung' 31
London trees 33
Notes on Tree-seeding 34
The Forestry of the National Reservations in America ... 35
The Madras Forest Code 35
Afforestation in England 73
The fall of the leaf 77
English Forestry 78
Canadian Timber 87
An Arboretum in Australia 80
Patent Wood Fibre 80
Pice Packets of Quinine 91
The Brandis Prize Fund 81
Tapping of a Para rubber tree in Ceylon 82
The Classified List of Forest Officers 82
The National Government and the Natural Forests in America 117
Wood-paving 119
Pension Rules of trained officers 121
Impression of a duck found in a tree 121
Forest fires in France 122
A new tree-climbing apparatus 122
Flowering and seeding of forest trees 123
Obituary, Mr. R. H. C. Whittall 123
Afforestation in the British Isles, by W. R Fisher ... 270
The planting of waste and unproductive moorlands in the Highlands 274
The utilization of waste wood and sawdust 277
" To make the Black country green " 278
Forestry at the Surveyor's Institution 278
The growth of trees 279
Seeding of forest trees 280
Sál-leaf blight in the Dún 156
Firewood splitting machinery for the Colonies and abroad ... 156
Imperial Forest School, Dehra. Prize Day 158
A Forest School for Ceylon 198
Artificial indiarubber from Cotton Seed 198
Mercantile aspect of Forestry 198
Seeding of forest trees 200
Extraordinary Crop of 'Hirda' fruit in Satara ... 240
Comparative effects of lightning on different trees ... 241
The strongest timber 241
Obituary, C. C. Abbey 242
The Physical test for Candidates from Cooper's Hill ... 308
Kamela Powder 309
The Gigantic Swallow-Wort 310
The Woods of Tasmania 311

The Brandis Prize, 1893 312
Forester and Lumberman in the Adirondacks by G. Pinchot 318
The use of Sawdust in the propagation of Plants by cuttings 354
Monsoon and Trees 355
Myrica Nagi, Thun, by D. Hooper 356
Accident to Col Bailey 356
The New System of Coupes in the C. P. 399
Seeding of Forest Trees 400
Bamboo Seeding in Bengal 400
Foresters as Cyclists in France 400
The Restoration of Scenery 400
Woods used in India for the Construction of beer-barrels ... 433
On the Utilization of waste produce of Forests and Woodlands 434
Message from Mons. C. Broillard to French-trained Forest Officers 441
A Forest Réunion in France 471
Mixed Oak and Beech Forests in the Spessart 473
Mr. Cotes' Zoology Manual 483

VII.—Timber and Produce Trade.

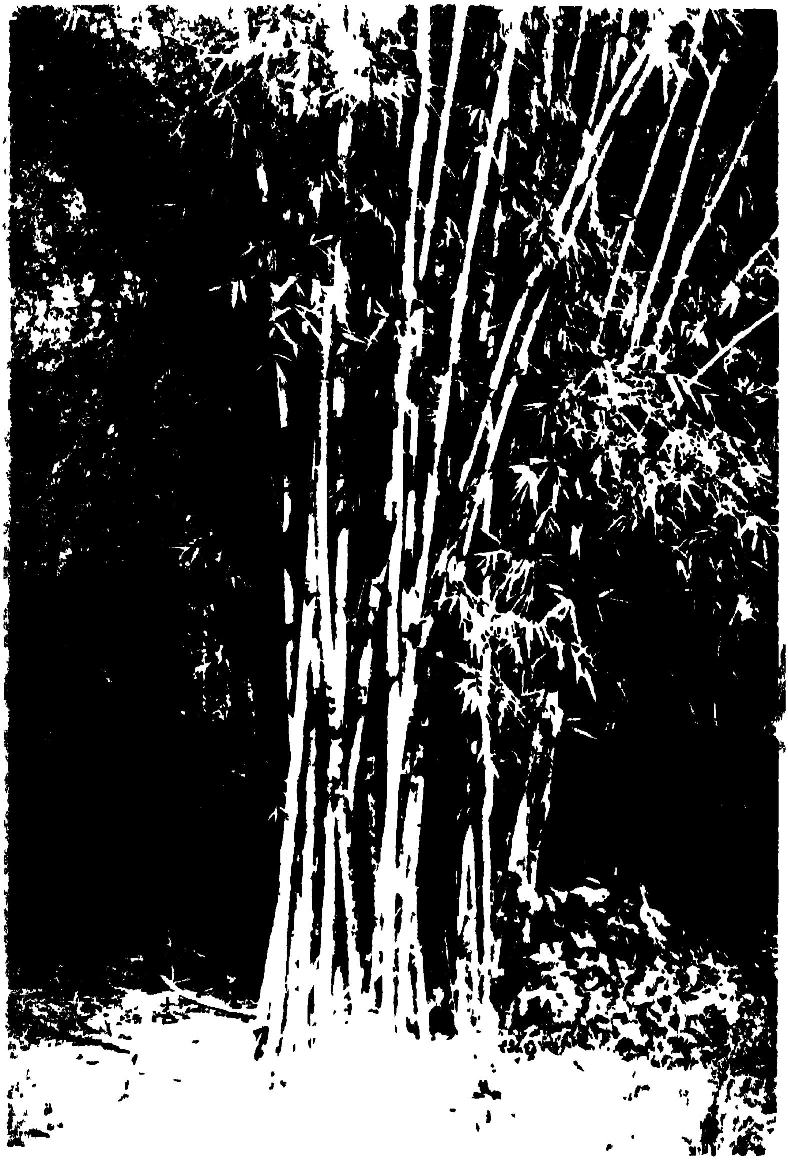
Churchill and Sim's Circular ... 36,82,125,166,203,242,281 320,361,404,443,484
Market Rates of Produce 36,84,126,167,203,243,281,320 361,404,443,484
Cawnpore Price Current ... 37,84,126,167,204
The Teak Market ... 124,204,260,441
Trade of Bangkok ... 163
Trade of Chiengmai in Siam ... 164
The Indian Timber Trade, ... 200
Average Selling Rates, N. W.-P. ... 205,359

VIII.—Extracts from Official Gazettes.

Supplements.

Appendix Series.

Chaulmugra Oil.
Garjan or Kanyin Oil.
In or Eng Oil
Blackwood or Rosewood of Southern India.
Mixed Forests, and their advantages over pure Forests, by J. Nisbet.
Climatic Influence of Forests, by J. Nisbet.
Advantage of Underplanting, by J. Nisbet.
Soil and situation in relation to forest growth, by J. Nisbet.
On the Selection of species of trees for Woodland Crops, by J. Nisbet.
Enhancement of Increment, by J. Nisbet, D. Oec.
Report on Forest Administration in Germany, by G. A. Hight.



[illegible] PHOTO [illegible] COMPANY

THYRSOSTACHYS OLIVERI

THE

INDIAN FORESTER.

Vol. XX.]   January, 1894   [No. 1.

A handsome new Burmese Bamboo.

The picture which forms the frontispiece to our January number and consequently to our twentieth Volume, represents a new bamboo from Upper Burma, belonging to a new genus *Thyrsostachys*, which is characterized by its thyrsoid paniculate bracteate inflorescence and paleæ keeled in the lower flowers and not or hardly keeled in the upper and having the lower ones deeply divided so as to present two long tails. The bamboo was discovered by Mr. J. W. Oliver, Conservator of Forests of the Eastern Circle of Upper Burma, and the photograph, from the negative of which our picture has been obtained, was taken by him. It is, therefore, only appropriate that its name should be *Thyrsostachys Olivieri*. Full description and plate will shortly be published in the Annals of the Royal Botanic Garden, Calcutta. Mr. Oliver says that the *Thanawa*, as it is called in Burmese, is in considerable demand, though the culms are not quite so strong as those of some other species. Large quantities of the seed were distributed from Burma and we have it growing excellently in Debra Dun where there is a considerable patch of it planted at Lachiwala, doing very well indeed. As the picture shews, it is likely to be as ornamental as it is useful.

J. S. G.

A Tour in Jaunsar. *(concluded.)*

THE SLEEPER WORKS.

The Sleeper Works are at present going on in the Dopta Block on a steep slope facing south west.

The trees are marked by the divisional officer or the forest ranger with a blaze and the divisional hammer. They are then felled by a special gang of men, generally Garhwalis from the neighbouring villages. The rates paid are as follows :—

All dead trees, each	4 annas
For a green tree 6—8 ft. girth ...	... 6 annas
ditto 8—10 „ ...	... 8 „
ditto over 10 „ ...	... 12 „

The felling is done with the axe alone, and the trees are generally felled sideways, *i.e.*, neither up the slope nor down it; this tends to lessen the chance of breaking.

The tree is then sawn into logs of the requisite length—in the case of metre-guage sleepers, 6 feet 3 inches long, and in the case of broad guage sleepers 10 feet 3 inches long. Each log is then rolled down to a convenient place for the sawyers and is rough squared on four sides by means of the trimming axe. The axe used varies according to the workmen—Kulu men using a broad bladed axe weighing about 14 ℔s, Punjabis a thicker narrower and lighter axe weighing 6 or 7 ℔s; in both cases the handle is long.

The saw in use for cutting up the logs into sleepers is a frame saw bought at Amritsar, but manufactured either at Sheffield, or at Solingen in Germany.

The following rates are paid for sawing :—

B. G.	1st Class	6 as. each
	2nd „	4 „ „
	Rejected	2 „ „
M. G.	1st Class	2 as. 9 p. each
	2nd „	1 „ 9 p. „
	Rejected	9 p. „

In the forest, to allow for wear and tear in transit, the sleepers are sawn to the following dimensions :—

B. G. 10′ 2″ × 10¼″ × 5¼″
M. G. 6′ 3″ × 8¼″ × 4¾″:

the dimensions required by the railway authorities being respectively 10 × 10″ × 5″ and 6′ × 8″ × 4″.

The sleepers are then stacked and inspected by the forest ranger, who passes them and marks them with a broad arrow, as follows :—First, every sleeper is marked once on the broadside, to denote that it is Government property; then a *first class* sleeper receives three marks on one of the narrow sides; a *second class* sleeper receives two marks, and a *rejected* sleeper one additional mark, both on the broadside.

A first class sleeper must have the proper dimensions, must be free from cracks and knots, especially at about 18 or 30 inches from either end, according to the size (M. G. or B. G.) and must contain no sapwood. Second class and rejected sleepers fail in one or more of these qualities. The first and second class sleepers are then carried to the head of the sledge road at Chabbai and piled up in large stacks. Rejected sleepers can also be taken down to the Dun as there is a fair market for them in Dehra for building purposes.

The cost of carriage from the forest to Chabbai varies with the distance, the rates paid this year from the Dopta block being about 6 annas for a B. G. and 3½ annas for a M. G. sleeper.

For logging, the Kulu men use a two-handed cross-cut saw, and the Punjabis use an ordinary saw, about three feet long. An experiment was made in the presence of the students to test the respective merits of the saw used in Jaunsar, the new German saws from the Forest School, and the Punjabi saw ; two large trees were felled and sawn up into logs, with the following result.

The Punjabi, working by himself, took on an average six minutes to saw through a square foot ; the Kulu men, working two together, with M-tooth saw took 4·4 minutes to cut through a square foot ; with the upright isosceles triangle, took 5·3 minutes; and with the ordinary cross-cut saw, as used in Jaunsar, 10·9 minutes. This experiment, as far as it goes, shews that the Punjabi can do more work in a given time than the Kulu man, and that of the cross-cut saws, the M-tooth one is the best. These saws are manufactured by Messrs J. D. Dominicus and Söhne, of Remscheid-Vieringhausen, Rhenish Prussia, and cost about Rs. 5-8 each landed at Bombay.

We took advantage of the measurements of one of these trees to ascertain the reducing factor. The girth at the base was 128″ ; at 10 ft., 112″ ; at 20 feet, 106·5″ ; at 30 feet, 102·5″; at 40 feet, 98·5″ ; at 50 feet, 92″ ; at 60 feet, 89″ ; at 70 feet, 82″ ; at 80 feet, 75″ ; at 90 feet, 70·5″ ; at 100 feet, 63·5″ ; at 110 feet, 62″ ; there was an additional length of 30 feet too small for timber.

We thus obtain the mean girth of each log in inches, and multiplying the square of this by 0·08 we get the area of the mean section, and thus arrive at the true volume of each log. Adding all those together, we obtained 499·92 cubic feet as the real volume, and with 1274·31 cubic feet as the cylindrical volume deduced from the total height (140 feet), and girth (128″) at the base, we found 0·39 as the reducing factor. Last year we found 0·47 as the reducing factor for a tree 13 feet girth at the base. It is obvious that this factor will not tell us how many sleepers can be obtained from a tree of this girth ; all we learn is that the tree contains so many cubic feet. To ascertain the number of sleepers we must be guided by past experience.

We noticed heart-shake in the tree we cut up, owing probably to rapid growth ; the shake extended from the centre for 3 or 4 inches radially in opposite directions, and would render a portion of each log unfit for sleepers.

MANUFACTURE OF DEODAR OIL AND CHIR PITCH.

This is effected by the destructive distillation of chips of deodar wood taken from the heart-wood of stumps. The kiln is made of stones and mud mortar, and is faced with lime inside. It is egg shaped, 5 feet deep, 4 feet greatest diameter at six inches above the base ; the base has a diameter of 2 feet, and the top of 2½ ft.

About 13 maunds of wood are put into the kiln and fire is applied at the top, and the supply of air is regulated by partially closing the mouth. One charge yields 2 maunds 10 seers of oil and 1 maund 4 seers of charcoal, and it is estimated that the cost per maund of oil delivered in Chakrata is Rs. 5-10-7. The oil is not pure, and at present there is no sale for it on a large scale, though it would doubtless prove a valuable disinfectant. It is a safeguard against bites of the "potu" fly.

A similar preparation is that of Chir pine tar, described as follows in the Journal for 1891 :—

"The tar is separated by subjecting small pieces of Chir pine wood to slow, incomplete combustion in a kiln, through which only a small supply of air is allowed to pass

The kiln is made of stones and mud mortar, the interior being faced with lime, and is egg shaped inside : its height and also its maximum diameter being 5 feet. It tapers towards the lower end, into which is fixed a perforated iron plate. At the upper end of the kiln is an opening 2 feet in diameter.

The wood, cut into long strips 1 or 2 feet long and 4 or 6 inches round is introduced at the upper end of the kiln. The pieces of wood are packed as tightly as possible, the closer they are together the better. The upper opening is then closed with a dome of stones and mud mortar, three holes being left to admit air. The wood is lit from the top and burns downwards, the rate of burning being regulated by closing or opening the different holes.

The charge of the kiln is about 15 maunds, and it takes 6 days to burn, the volatile products being driven off and charcoal remaining in the kiln.

Crude tar, organic acids and water pass through the perforated plate at the bottom, and are collected in tins. Good pitch, the cost of which has been estimated at Rs. 4-8-0 per maund delivered at Meerut, has been made by driving off the water and organic acids.

The cost of the kiln was Rs. 13.

From 15 maunds of wood thus subjected, we get 6 maunds of charcoal and one and one-fifth maunds of crude tar.

The tar is used locally for railings, &c, and the pitch is used on iron roofs. There is probably a more ready sale for this production than for deodar oil.

THE DEOBAN KARSHU FOREST.

Owing to delays in marching caused by the heavy winter snow, we were only able to devote one morning to the interesting forest on the slopes of the Deoban hills; hence what follows is taken principally from previous journals.

The Karshu forest occupies the top of the Deoban hill, at an average elevation of 8,500; it consists principally of Karshu oak, with spruce and silver, the latter especially in the western side.

On the northern slopes below Snow View, where the soil is fairly rich owing to a combination of shale and limestone, and the gradient not too steep (about 28°), the karshu oak forms an almost pure forest, and attains good dimensions. In 1888, we measured the height of two oaks with Abney's level; one was 117 feet and another 94 feet. We also measured an old stump which had a girth of 15 feet.

The natural reproduction of this oak by seed is fairly good; on a piece of ground 10' by 10' we counted 205 seedlings, which gives about 90,000 per acre. This, however, was in an area free of *Strobilanthes*, which, as a rule, covers the ground in this forest. The history of this plant is exceedingly interesting, and for a full account of the species found in the Nilgiris, see a paper in the *Indian Forester*, Volume XIV, No. 4, for April, 1888, by Mr. Gamble. The chief species found at Deoban are *S. Wallichii,* and *S. alatus.* Every year the upper herbaceous portion breaks off at a node, leaving the woody stem beneath, which increases in length by one or two inches every year, until at the time of flowering, when the plant dies, this woody portion is two feet high, the height of the whole plant being five feet The last seeding took place in 1881-82; the new shoots (the woody portion) are now from 12 to 15 inches high and about eleven years old. When the next flowering will take place we do not know, but it is believed that the whole term of this plant is about 12 years.

In all probability it is only when this plant dies down that the young karshu seedlings are able to force their way successfully through the dense network formed by the roots.

The *Strobilanthes* is a plant which flourishes under the dense cover of the silver fir; it is also a favourite fodder for sheep and goats, but grazing cannot, of course, be allowed here as the karshu seedlings would be destroyed.

In July, 1887, Mr. Moir sowed karshu acorns in contour lines six feet apart, but they were nearly all destroyed by the larva of a moth. This acorn has numerous enemies, principally birds, squirrels, and bears. The karshu acorn is ripe in July and August, and germinates as soon as it reaches the ground. The germination of this oak is peculiar. From the acorn there issues a long cotyledonary tube at the end of which is carried both the radicle and the plumule. The radicle then forms a thick carrot-like tap-root, fed by the nutritive materials from the cotyledons, and the plumule bursts out from the crown of this taproot. On this subject, the reader is referred to *Indian Forester*, *Vol XVII*, p. 48, for an interesting article by Pandit Keshavanand. The germination of the Moru Oak is somewhat similar.

The sowings were renewed in 1888, and the countings we made shewed on an average one seedling per foot of contour line. They are now thoroughly established and are doing well, although the rate of growth at this elevation is necessarily slow.

In 1892, the students pulled up the *Strobilanthes* by the roots over an area of about 1-12th of an acre ; and this work has since been continued, and there is now an area of 5½ acres quite free from *Strobilanthes*. We found numerous seedlings in the cleaned area and it is expected they will grow all the better for this operation. The cost is about Rs. 6½ an acre. The natural reproduction by seed of this oak presents matter for further study, and we cannot as yet determine what is the best kind of felling to make in these forests ; one point should never be lost sight of, and that is, at this elevation, wind, storms, and heavy snow have to be taken into account, and the selection method by which the cover is kept as complete as possible, is indicated. On the western side of this hill, there are patches where the selection method may be shewn as a type, chiefly in silver fir ; but on the northern side, in the Karshu oak, we do not find all ages mixed on the ground. The present appearance of the forest, where fuel fellings have taken place, is that of a severe seed felling, and it remains to be seen how the reproduction will come on.

There are many interesting species in the undergrowth, of which the more important are :—*Skimmia Laureola*, a small shrub belonging to the N. O. *Rutaceæ* with a strong aromatic odour ; the native name of this plant is "Kustoora chara," and the odour of the musk deer is popularly supposed by the hillmen to be derived from the leaves. *Salix daphnoides*, a willow with lanceolate glabrous, slightly serrate leaves, glaucous beneath, capsule glabrous. *Viburnum cotinifolium*, N. O. *Caprifoliaceæ*, leaves with dense grey tomentum underneath, ovate or rotundate, 3 to 5 inches long, with short thick petiole. *Viburnum nervosum*, *V. stellulatum*, *Spiræa canescens*. a species of raspberry *Rubus niveus*, various species of *Lonicera*, *Berberis*, and many others.

Another interesting species is the larger ringal (*Arundinaria spathiflora*) ; it flowered all over Jaunsar in 1882, and a few of the dead stems may still be found, though they are quite rotten ; it is chiefly used as pipe stems, and it also forms excellent fishing rods for trout and mahseer. The ground is covered with young seedlings, which are now about six feet high. It will be some years yet before the stems of this bamboo attain the height and size requisite for fishing rods, and it is probable that the term of this species is longer than was originally supposed. It can be at once distinguished from the lower elevation bamboo, *A. falcata*, by the cross veins.

In the Jadi block, just above the road to Kanjatra, there is a small karshu coppice of 1882; the average height of 282 shoots in 1888, was 4 feet 8 inches, and the average number of shoots per stool was 5½; very few standards were left, but a quantity of willow has come up on the ground; the aspect of this *coupe* is south-west. In 1891, the average height of 400 shoots was 6 feet 8 inches.

Another coppice in the Mohna block below Chakrata, view with a northerly aspect and cut in the same year, was also examined: the average height of 107 shoots in 1888 was 4 feet, and the average number of shoots per stool was seven. Only the leading shoot in each clump was measured. In 1892, we found the average height of the leading shoot in each clump to be 6 feet 3 inches. The karshu oaks pollarded in 1878, near the coppice in the Jadi block, shew an average height of 15 feet.

In the Journal of 1891, we found the following data regarding the rate of growth of karshu :—

"The students measured the girths of the Karshu and Rai in the sample plot in the Jadi block below the road to Bodyar: the results of the measurements since the beginning are given in the following table, which refers to the growth of the Karshu oak :—

Number of trees measured.	Class girth.	Mean Girth 1883.		Mean Girth 1891.		Mean increase		No. of years required for an increase of 1" radius.
		Ft.	in.	Ft.	in.	Ft.	in.	
60	Under 1½'	1	1·0	1	4·2	0	3 1	17·00
58	1'—3'	2	1·4	2	5·1	0	3·7	14·00
16	3'—4½'	3	8·2	3	11·6	0	3·5	14·75
2	4½'—6'	5	0·5	5	0·5	0	2·2	23·55

The measurements made, so far, seem to shew that it will take 180 to 190 years before this Oak attains a girth of six feet. Countings of rings on stumps which were made in 1892 serve to corroborate this.

THE DEOTHAT NURSERY.

This nursery, situated in the Mohna block about a mile below the bungalow, was instituted in 1878 for the purpose of raising plants to re-stock the blank slopes. Water is led by means of a small canal from a neighbouring spring, and stored in casks; and the beds are hand-watered wherever necessary. In 1891, there were about 17,500 Deodar transplants which have since been put out; and in 1892, about 12,000 plants were pricked out, either into nursery lines, or into baskets. This year there are 20,000 Deodar, and 20,600 Silver fir. The beds are protected against the sun by means of grass tatties.

Various plantations have been made from time to time in the Mohna block. In Katbau—North we visited plantation No. 4 of 1881 on an easterly aspect and gentle slope. It was sown with Deodar in 1881 and subsequently with blue pine in vertical lines and re-sown in 1882. Vacancies were filled up in 1883 with transplants from the Deothat nursery, and with spare plants from neighbouring patches. The first sowings were made too thickly, and in 1891, superfluous plants were cut out; we counted 76 stumps in one patch: with three plants left to grow. The following measurements have been made:—

1891, average height 135 Deodar ... 4 ft. 5 in.
1892, do. 574 do. ... 4 ft. 7 in.
do. do. 77 blue pine ... 3 ft. 7 in.

The average length of 26 annual shoots of deodar was in 1892, 10½ inches. Here as elsewhere deodar does best when sheltered by the pine.

In Rangai—North, we inspected plantation No. 5 of 1881. The soil is shallow and rocky and the general aspect is South. Deodar was sown in 1881 in patches 4 feet apart, in horizontal lines 15 feet apart. Blue pine was sown subsequently and vacancies were filled by putting out deodar plants in 1883. Lower down, where the soil is deeper and the area is protected by spurs on either side, the deodar is doing much better.

In compartment 14 of the Mohna Block, beyond Kauntilani, is situated a plantation of 1881. Deodar and blue pine, raised in the nursery, were put out in August 1881, when about 2½ years old (seed of 1878), in alternate lines 14 feet apart. The aspect is S. and S. W.

In 1888, average height of deodar ... 5 ft. 0 in.
do. do. blue pine ... 10 ft 0 in.
1892, do. of 31 deodar ... 7 ft. 3 in.
do. do. „ 51 blue pine 12 ft. 0 in.

The average length of 31 annual sheots of deodar was 11 inches.

In all these plantations in the Mohna block it would have been better had the plants been sown or put out much closer, say 5 ft. × 5 ft..

Sowings in Kanjatra Block.

In 1885, spruce and silver fir were sown in contour lines one foot wide, and 8 to 10 feet apart. The growing stock is young spruce fir, with a little silver, on a north westerly aspect and the natural reproduction is almost nil. The total length of of the lines is about 18 miles, and the cost of making them was Rs. 164.

The following method of recording the success or failure was adopted: a stick four feet in length is placed along the line; if one or more seedlings are found within that length, it is recorded as a success, if none are found, it is considered a failure. Counting on this system in 1888, silver fir showed a success of 50 per cent., while spruce fir showed a success of 32 per cent. As the two species were sown in alternate lines, at any rate below the road, this shows that the spruce fir has largely died out; the reasons for this probably are:—1st, want of sufficient light; 2nd, too much moisture; for a little further on, where the lines turn round a spur, we noticed that the spruce fir had done very well.

In 1891, the success of both species was estimated at 40 per cent; and in 1892, the success was found to be 37½ per cent. Another method of shewing the results is to say that there is a plant on an average to every 6½ feet of line. In 1892, a spruce seedling was found with a height of 18in., and another with a height of 16 in., and two silver firs gave an average of 10 in. In the forests beyond the Kanjatra block, good natural regeneration of silver fir was noticed under thick cover: spruce fir found naturally where the cover was very light or interrupted, being as a rule, confined to the ridges.

We inspected the fuel works in compartment 5 of Kanjatra forest, Deoban Hill. The following general description applies to fuel works in this range:—

After the trees are felled, they are cut up by means of the cross-cut saw into lengths of two feet; these logs are then split by axes and wedges into pieces of convenient size, no piece being allowed to weigh more than 12 seers, or to be more than 9 inches diameter. The fuel is then placed in stacks of the following dimensions, 21 feet long, 6 feet high and 2 feet broad; this is supposed to contain, and is counted, as 200 cubic feet of fuel, 1 foot in length and 1 foot in height being allowed for shrinkage, loss in re-stacking, &c. The rates paid for felling, logging, and stacking are as follows:—Oak, Rs. 2 per 100 cubic feet; fir, Re. 1-12-0 per 100 cubic feet; this work is done entirely by hillmen, who earn in the course of the year about Rs. 2,300 at this work alone.

The fuel is carried on mules and ponies to Chakrata, at the following rates:—

Oak, Re. 1-6-0 per 100 cubic feet per mile.
Fir „ 1-2-0 ditto ditto.

Every quarter of a mile is marked along the fuel roads, and the nearest quarter of a mile to the fuel stack is taken into consideration when paying the carriers. At the present rates received for the fuel in Chakrata, it does not pay to carry the fuel from any place outside a radius of 12 miles from that station, hence the forests in the Deoban range must remain the chief source of supply for some time to come.

The trees to be felled are selected either by the ranger or the divisional officer : a small blaze is made on the tree and it is marked at the base with the divisional hammer. The tree is felled by the axe at about two feet from the ground, and is generally made to fall sideways. Felling by the axe causes a good deal of waste, but it is found almost impossible to cut large trees with a saw.

The weight of 100 cubic feet stacked oak fuel is about 40 maunds when fairly dry, and that of 100 cubic feet fir fuel about 28 maunds.

Wherever fuel works are going on, a series of roads or carrying paths four feet wide have to be made. As a rule they have to be metalled, and the Deoban limestone furnishes a good material for this purpose, whereas the shale is too soft and only lasts one season. These paths cost about Rs. 4 a chain to make and Rs. 2 a chain to metal. When the fuel works are over for any particular locality, the paths are allowed to fall into disuse ; but when the next felling comes round, they are easily cleared at a small cost and can serve again.

The fuel supply for Chakrata, which amounts to about 1,40,000 st. cubic feet per annum is derived from various forests in the Deoban Range :—Deoban, Lokandi, Konain, Kophti and Hajawa, besides the coppices at Gidhi Khud, Korwa and Kalsi.

Recruits for the Forest Department.

Under somewhat recent arrangements, based on the recommendations of the Public Services Commission, the Forest Service in India, as most of our readers are aware, has been divided into two main and entirely distinct Divisions known as the Upper Controlling Staff, and the Lower Controlling Staff. They might equally be termed, the Imperial and Provincial Services. The former is now recruited entirely and without exception in England, while the latter is recruited in India. Appointments in the Provincial Service are graduated from the lowest grade of Ranger on Rs. 50 a month, to the highest grade of Extra Deputy Conservator on Rs. 600, and the duties and responsibilities of Extra Assistant, and Extra Deputy Conservators are the same as those of Assistant and Deputy Conservators in the Imperial Service. The principle that men serving in their own country cannot expect the same rate of remuneration as those serving in foreign lands, restricts the salary of men in the Provincial Service to 2-3rds of that in the Imperial, in accordance with the rules in force in this respect.

With this explanation, we purpose to consider the question of the recruitment of the Department and whether the existing state of things satisfactorily provides the necessary recruits in sufficient numbers and with the desirable qualifications.

I.

For the Upper Controlling Staff, the members of which undergo a course of training at Coopers' Hill and on the Continent, it has been decreed that the Entrance Examination in England should be assimilated to the Entrance Examination for Sandhurst and the main object to be borne in mind with reference to this Examination is laid down as follows: "*to secure a youth who has had a thoroughly well grounded liberal education as an English gentleman.*" A recent prospectus, too, informs us that the Examination of candidates for the Police Department is to be "*simultaneous with and in the same subjects and papers as, the Examination for the Indian Forest Department.*" This general standard of Entrance Examination is doubtless most convenient for the Masters of Schools and for those whose business it is to specially prepare boys to gain admission at one or other of the doors opening to a career, but such a system goes to debar many boys from the selection of that career for which they are naturally most fitted and in which, by the early study of those subjects for which they have most taste they would be most likely to distinguish themselves in after life. Moreover, it is calculated to act adversely to the growing tendency in all Public Schools now-a-days to encourage the study of science at the expense of the classics. But apart from these considerations, there is the all important objection, from our point of view, to such an examination that it admits young men who know nothing of the sciences, and who, therefore, spend most of their time for the first year or year and a half at Coopers' Hill studying Chemistry, Physics, and the elements of Botany and Geology. That this is so, has been stated on the best authority, and it is fully borne out by the results of the Examination held last June.

The obligatory subjects are now (1) Lower Mathematics (2) English Composition (3) German; in all of which we venture to think half, instead of ⅓rd marks might well be exacted Of 36 candidates for 9 appointments, 28 took up French as one of the two optional subjects, and 28 chose either Latin, Greek or English History. Two only were examined in Physics, two in Botany, six in Chemistry, and six in Geology. Not a single candidate attempted Higher Mathematics. Of the nine who passed, three had a knowledge of Chemistry, one of Chemistry and Physics, one of Botany and Geology; while three owed their success to Latin and French and one to Latin and Greek. The proper course would, in our opinion, be to strike out Latin, Greek and English History from the optional subjects, and to allow candidates to take up any three of the remaining six, *viz*, Higher Mathematics, French, Chemistry, Physics, Botany, Geology. It may be accepted that three-fourths of the candidates would take up French, and a knowledge of two of the remaining five subjects might be readily insisted upon. Youths would certainly be forthcoming from the 'Modern Side' of the Schools, and it would not be any unreasonable demand on Messrs. Wren and

Gurney and others, that their candidates should undergo a special preparation before being acceptable for the Forest Department. If this were done, much time would be turned to better account at Coopers' Hill, more suitable material would be obtained for the Department, and recruits would find the life and pursuits of a Forester more to their liking. At Coopers' Hill itself, the course of study has now been arranged on excellent lines for the period of three years. We understand it to be, in a general way, as follows :

(1). For the first one and a half years the Students remain at Coopers' Hill where, while studying the auxiliary sciences, they are instructed in sylviculture and forest mensuration, have practical work in nurseries and the neighbouring woods and are then shown over some specially selected forests in Normandy.

(2). Then there is a practical course of five months in Germany, under selected Prussian Ober Förstcrs, directed by Sir Dietrich Brandis, K. C. I. E.

(3). The third year is spent at Coopers' Hill and devoted to the completion of the study of Forestry, the preparation of Working Plans, etc.

(4). Finally some of the most promising Students are deputed to visit forest districts in Germany on their way to India.

It is hoped that the above programme will be fully worked up to, and that it will not be curtailed or crippled by the all absorbing desire at Coopers' Hill to make the College self supporting in other respects.

If the course of study at Coopers' Hill and of practical training in France and Germany is such as will best meet the requirements of the Department, and we fully believe it is, the cost should be met and the India Office called upon to provide the necessary funds. Because the education of a Forest Officer is costly, it is no sound reason for sending insufficiently taught recruits to India. We quite accept the view that Government should obtain the men they require as cheaply as possible, but deprecate the false economy which, for the sake of keeping the cost within the College fees, would fill the Department with any but men fully qualified for their duties. A sufficient sacrifice was made to the Royal Engineering College, when that was first fixed upon as a substitute for what were then more efficient training grounds for Forest Officers, and now that the present scheme has been worked out and adopted, after eight years of untiring energy on the part of those directly responsible for the training of the young men, no financial considerations, which can at best be only of trifling import compared with the present value and future possibilities of the vast State properties to be administered, must be allowed to prevent its being fully carried out.

NOTE :—The recruitment of the Lower Controlling Staff, will be dealt with in a separate article (II).

Forest Administration in Oudh.

An important question affecting the welfare of the State Forests in the Gonda and Bahraich Districts of the Oudh Circle has just been finally decided by Government and a short history of the case may be considered interesting and instructive enough to be placed on record in the pages of the 'Indian Forester.' The Forests of the Oudh Circle were the property of the State unburdened with servitudes of any description, but in 1876 a special commission was appointed to enquire into the question of forest management in its relation to the agricultural necessities of the Province and the proposals of one of its members Captain (now Colonel) Pitcher, acquiesced in, practically entirely, by Government. These proposals included a recommendation that certain concessions in free produce and grazing at reduced rates granted to villages residing within a limit of 3 miles of the State forests, advantages conceded so far back as 1865, should be continued to these villagers, and this principle was approved of by Government generally and lists of privileged villages were ordered to be compiled. Captain Pitcher however pointed out that in the Tulsipur parganas of Bahraich and Gonda the State forests had been already freed from the burden of providing free produce and grazing by the gift to the Maharajah of Balrampur, the owner of these parganas, of an area of State forests equal to about one fifth of the extent of the Reserves in the Gonda District and he placed on record that, in drawing up for Government sanction a list of privileged villages, those within 3 miles of the State Forests in these parganas should be excluded therefrom. So far there was nothing to complain of in the procedure adopted, and had the terms of agreement on which the 40 square miles of forest land were ceded to the Maharajah been committed to writing and duly signed by the interested parties, no future difficulties would have arisen. Unfortunately however no such arrangement, which might have been considered to be an ordinary business-like transaction, was ever completed, and disputes immediately arose as to the terms on which this gift of a large area of valuable forest was made. The Department held, and, so far as can be ascertained from the correspondence, with justice, that the remainder of the State Forests in the Gonda District under their charge was freed for ever from the burden of providing grazing or produce to the Maharajah's tenantry, whilst the Maharajah on the other hand insisted that this ceded area was only to supply a portion of his tenantry with their requirements in forest products and that the remainder had still a claim to be supplied from the restricted area of State Forests. This dispute was continued for some time during which the tenantry of the Maharajah grazed their cattle in the State Reserves, the payment of dues being postponed pending settlement of the question. The amount due from the Maharajah reached a very considerable sum and ultimately by executive order of the Local Government permission was given to him to graze cattle in the State Reserves at reduced rates whilst his tenantry continued to extract free produce from these forests. The 40 square miles of Forest handed over to the Maharajah remained his absolute property and no rules were laid down as to the disposal of produce therefrom although this area was originally ceded for the benefit of his tenantry. It must not however be supposed that these results were acquiesced in by the Department who thus found itself not only ousted from the management of the fifth of the original area under its control but besides had to supply produce from the restricted area remaining in its charge ; but it was not till 1889 that an opportunity again occurred of reopening this vexed question. In that year the first so called Balrampur grazing Lease, by which free produce and grazing at reduced rates were enjoyed in the State Forests expired, and every effort was made on the part of the Department to oppose its renewal. The reasons for this opposition were good. During the period of the first lease the value of the State forests had largely increased, communications were improved and the enforced opening to grazing of a large proportion of the area of State Forests had become harmful to the general protection and improvement of the forests and therefore injuriously affected the revenue. But the efforts of the Department proved unsuccessful and a new grazing Lease was sanctioned by which for a period of 7 or in certain circumstances of 10 years, 50,000 head of cattle might graze over State Forests in Gonda ; while it stipulated that not more than one half of the whole area (155 miles) should be closed to grazing, and moreover contained a clause to the effect that the grant of free produce should be continued to the tenantry as heretofore. The Department now found itself in a worse position than ever ! The 77 square miles of reserves to be kept open to grazing were selected from the total area in localities easily accessible to the requirements of the Balrampur tenantry and the open areas were so distributed that practically the whole of the Reserves in the Gonda district were worked to suit the convenience of the tenantry of one land owner. Relief, however, unexpectedly arrived in 1893, for whilst compiling the Register of Reserves for the circle it was discovered that no list of privileged villages had ever been sanctioned by Government for the Gonda District, and on the preparation of this list being ordered, former correspondence was brought up which conclusively proved that for 16 years the inhabitants of the District had been in receipt of free produce on the authority of lists prepared without the sanction of the Local Government. At this distance of time it appears fortunate that the laxness of the Forest and District officers in complying with Government orders occurred, for otherwise an authorized list of privileged villages might have been attached to the record of the Balrampur grazing lease and more troubles have arisen. But be that as it may, the opportunity had again arrived to represent the difficulties caused by the present state of affairs and this time to a Government willing to acknowledge the Provincial and Imperial value of forests and averse to sacrifice these interests for the temporary benefit of an individual or even of a generation. In deciding this case it had to be taken into consideration that the Balrampur state had enjoyed very considerable concessions for many years and that Government were to a certain extent bound by the executive order of their predecessors in the so-called grazing lease but fortunately the question of the claims of the Estate had already been reported on under the orders of Government in 1876 by Captain Pitcher, and although the conclusions arrived at by that officer were different to those expressed in his special report on the management of the forests in reference to the agricultural requirements of the tenantry issued a few days later, yet it could not be considered unfair to accept with his other proposals for forest administration also those relating specially to the concessions claimed by the Maharajah. At that time when all circumstances connected with the free gift of an area of 40 square miles were fresh in the memory of those interested in Forest management, Captain Pitcher appears not to have experienced the slightest doubt that the considerations for this gift had now been fulfilled by the Estate, but he was also apparently of opinion that the vacillation of the Department and the absence of a written agreement had rendered a summary settlement of the matter somewhat difficult. He proposed, therefore, alternative courses, which speaking generally were: the one that the 40 square miles of forest land should revert to departmental management and the whole area of State reserves be burdened with the supply of free produce and grazing to the surrounding tenantry; the other that such tenantry as the Maharajah could not or would not supply from these 40 square miles should receive produce *on payment* from the State forests. It is strange that neither of these proposals were acted upon at the time, and that in 1893, 16 years later, the latter alternative should be accepted in solution of a question which up to the present had remained unsettled. This settlement it must be explained is more favourable to the forest than would appear at first sight, for the struggle between the Estate and the Department was not based on the necessities of the tenantry. Fully 50 per cent. of the so called privileged villages did not avail themselves of their privileges, especially in grazing where payment was required; and it is confidently expected that under the new rules the demand on the State Forests will not be large enough to cause any serious drain on them nor to hamper their future systematic management The number of cattle entitled in future to graze on payment will be limited to such whose owners can prove necessity for the use of State Forests, and certainly will not amount to more than ⅔ of the number permitted to graze under the so called Lease, whilst the exaction of a payment for produce however small will reduce the demand to actual requirements and prevent waste. It has been said at the commencement of this article that the subject was interesting and instructive; the interest to a forester consists in observing how in the young days of conservancy the department possessed insufficient influence to efficiently protect State Reserves and, aware of its weakness, appears to have shown hesitancy and variation in its plan of action ; instruction is amply conveyed when reflecting that this whole series of troubles was caused by an omission to obtain over the signature of the contracting parties a written agreement embodying the considerations for which the gift of forest land was made. Owing solely to this omission we have the strange spectacle of the claims on a State Forest being commuted by handing over to the use of the tenantry a large area of forest land, and then of the same Government which made this gift burdening the now restricted area of Reserves with the same concessions, and moreover granting these concessions in such a manner as to seriously interfere with the manaugement of the whole forest area. For 16 years, these concessions have been enjoyed without right or title and so intricate was the entanglement caused by the carelessness of former executive and administrative officers that Government while of opinion that no benefit had been reaped by the gift to the Maharajah could not find it expedient to at once cancel the grazing lease and order the management of the Reserves to revert to the Department. We can therefore congratulate ourselves that the matter has now been finally settled with justice to the forests tempered with due consideration for the tenantry.

O. C.

Another effect of the influence of Climate on Forest Vegetation.

It is generally known that the character of forest vegetation mainly depends on two causes—the locality and the climate. The latter cause is probably the more powerful element in this respect. It is simply due to the change of climate that some trees which form very extensive forests in the moist region would simply vanish in similar localities where the annual rainfall does not exceed 20 inches ; while there are others which would hardly be found except in localities where the annual rainfall falls below 20 inches.

As an instance of the first type of trees may be mentioned the three-needled Pine of the Himalayas, while the Edible Pine and *Quercus Ilex* may be mentioned as representing the latter kind of trees.

Again there are others which would grow both in the dry as well as in the moist climate, though they may not attain equal dimensions under both these circumstances. Deodar, the most important tree of the Himalayas, is one of such trees.

The great difference between the size of the trees of *Pinus longifolia* found in Khanpur in the Hazara district where the climate is comparatively dry, and those found in Nûrpur in the Kangra District, is no doubt owing to no other cause.

Now, it is true that Deodar does not confine itself to the moist region of climate nor does it ever suffer from an excess of moisture in the air, but the further we penetrate into the Himalayas in the dry region of climate, the slower we find its growth.

And all slow growing species, are, I believe, much more valuable as timber trees than the fast growers.

The inference may therefore be drawn that a Deodar tree which grows in a dry climate where its growth is comparatively slow will yield a more durable wood than the one which comes up in the moist region of climate. But the case is just the reverse.

If the Deodar wood grown in the dry climate remains exposed to sun and rains for a time it changes its color and cracks and splits very badly. Nor does it contain a sufficient quantity of resin. So it is much lighter than, and consequently inferior to the rapid grown wood of the moist climate.

Besides the slow growth and small size of trees, the inferior quality of wood is therefore another thing which is due to climatic influence.

The very marked difference in the quality of the Deodar wood sold at the different sale depôts in the Punjab is probably due to this one cause.

The Ravi Deodar is said to be the most durable. Next to it comes, I believe, the Chenab Deodar and the Jhelum Deodar is not inferior to that of the Beas, which latter is much superior to that of the Sutlej.

Now, what is said of Deodar wood under such circumstances is equally true of all other species.

Thus as a matter of fact the climate forms the mainspring of the machinery which regulates all important changes in the Forest vegetation.

KULU, }
18th May, 1893. }

MIAN MOTI SINGH.

II.—CORRESPONDENCE.

Publication of Forest Statistics.

DEAR SIR,

It would interest many of your readers were you to publish annually a comparative statement exhibiting the total Revenue and Expenditure (A and B) as well as the area in square miles of each Province under the Government of India and the Presidencies of Madras and Bombay (Sind to be shown separately). It is presumed these figures are always at your command, and can be tabulated with facility. Conservators doubtless have them; but Divisional Forest Officers cannot always obtain them. Besides it is befitting that a magazine like "*The Indian Forester*" should supply this information to its readers for it is not only to Departmental men that it finds its way. It would be interesting to see which Province or Presidency is the most lucrative from a forest point of view to the State.

G. E. M.

We will endeavour to comply with our correspondent's request at an early date. The information he refers to is, we believe all regularly given in the Inspector General's yearly summary which is widely circulated and which we hope soon to review.

HON. ED.

Forest Administration in the C. P.

SIR,

The article on Forest Administration in the Central Provinces in your September number shows that province as about to pass through an important epoch in its forest history. As one who has no personal acquaintance with those vast forests, I should be glad if Tuscau would enlighten me on a few points.

Over one-fifth of the area in the Northern Circle or 2,249 square miles is to be excised from the Government Forests presumably for the purposes of cultivation. Is there any possibility of this large area being rapidly settled by bonâ fide cultivators seeing that there are 11,014 square miles of malguzari and zamindari forests in the same tract, much of which also is, presumably, fit to be brought under the plough? Is there no danger of much of the land being acquired by such classes as banjaras simply for the sake of working out all forest produce of value to the great present detriment of Government Forest Revenue; and when everything has been exploited, will not they abandon their settlements, without having brought the land under permanent cultivation at all?

I understand that the closed forests are not worked at all or only in rare instances, and that, as a rule, forests are not worked unless all the kinds of trees composing the stock can be sold; thus, when there is no sale for firewood in a mixed forest, the timber trees are left unfelled, although there may be a good market for them. If this be the case what is the reason of the rule, and may it not happen that no firewood will be saleable for the next half century or longer?

From a valuation survey of not quite 200 acres, working plans are to be framed for over half a million acres and it is apparently contemplated to work nearly all the forests in the province on the Coppice with Standards method of treatment and on the strip system. Eventually, therefore, there will be from 10,000 to 15,000 square miles of Forest throughout the province presenting the appearance of a vast chess-board with small parallelograms 10 or 20 chains long by 5 chains broad. This seems an ambitious programme even for the Indian Forest Department and it would be interesting to hear whether the coppice with standards system is to be applied also, as is understood has already been done in some instances, to the reserved forests, and to those where timber growing is the most important object. Why has the strip system been chosen; it is most troublesome to carry out in practice, and is generally only employed in exceptional circumstances, but here apparently strips are to be made irrespective of the nature of the ground, of the climate or of the stock?

The method of calculating the area of each working circle seems peculiar. A valuation is made of the outturn of about 200 acres of forest, 30 standards being left to the acre. The yield in timber and fuel is found to be 5 tons per acre. As the requirements of each neighbourhood are known with tolerable accuracy, taking 30 years as a suitable rotation, the area of each working circle is determined on this basis, but then, strange to say, we find that the number of trees to be reserved per acre is fixed at 60 instead of 30 *besides all trees having a circumference of 3 feet.* The reservation of so many additional trees must completely upset the previous calculations as to yield and if no trees of three feet in girth or over be cut, will not the timber supply be materially reduced? Will it be possible always to find such a large number of reserves and is it advisable in the interest of the coppice to retain so many?

Apparently, the forest area is at present sufficiently large in many localities in proportion to the demand for forest produce, to admit of only portions being marked off as working circles. In such cases, where is the necessity for rigorously defining the area of the working circle at all? For example: there is a forest of 1,200 acres, of which it is estimated 20 acres per annum will suffice to meet the present demand for forest produce after adding 50 per cent to meet a probable future increase in the demand. Then, the rotation being twenty years, the working circle, would be 600 acres or half the forest. The estimate, however, of the yield and of the probable increase in demand being of necessity very rough, why not simply leave the area to be worked yearly to depend entirely on the demand, with the proviso that the area worked over does not exceed 40 acres, the possibility of the forest?

TAU THA.

"Border" on Esprit de Corps.

SIR.

I am sorry that "Border" compels me to take up some of your space in self defence. I feel no "contempt" for brother foresters of any class. A correspondent having asserted that Cooper's Hill men were the élite of the Department I simply ventured to remind him that he was a little too previous, as it will be some years before Cooper's Hill names occupy the top of the list. There is no shadow of "contempt" in this, and it was written as a perfectly colourless argument relevant to the point under discussion. Neither have I any but kindly feelings for our "untrained" brothers, though I did, and do, smile rather loud at an egregious contention put forward on their behalf. I fancy the Secretary of State would smile too, at hearing unskilled labour declaring aloud in the market that it was at least as good as skilled labour. It is antics such as this that imperil our union, rather than a hypothetical contempt attributed gratuitously to

VELLEDA.

III.-OFFICIAL PAPERS & INTELLIGENCE.

Reorganization of the Executive Staff.

The following is the text of the Despatch sent Home in May last on this subject by the Government of India.

In despatch No. 312 (Financial), dated the 1st October 1890, we intimated our intention of subsequently taking into consideration the reorganization of the Executive Staff of the Forest Department. When maturing our proposals for an increase in the strength of the Superior Forest Staff, contained in that despatch, we had in view the probable necessity of reorganizing the Executive and Clerical Staffs as a necessary complement to the general scheme which has been under consideration since the receipt of Sir D. Brandis' letter of the 5th August 1886, forwarded with Lord Cross' despatch No. 83 (Revenue), dated 23rd September 1886.

In pursuance of this purpose as regards the Executive Staff, Local Governments and Administrations were asked, in January 1891, to state the number of Rangers, Deputy Rangers, Foresters, and Guards considered indispensable for the efficient management and working of their forests. One of the material objects of the proposed reorganization was also the attraction of a better class of candidates for employment in the Subordinate Forest Service ; but Local Governments and Administration were enjoined, when submitting their applications, to keep in view the financial condition of forest-administration, as the Government of India could only entertain proposals for increased expenditure which were fully justified by the special circumstances of each case.

The replies received were summarized in a note by the Inspector General of Forests dated 3rd June 1892, in which the whole subject has been dealt with in detail. We should invite Your Lordship's special attention to this note, which is recorded in the Forest Proceedings of the Revenue and Agricultural Department for October 1892, Nos. 1—35. As the suggestions embodied in the note differed in some important respects from the proposals first submitted, Local Governments and Administrations were asked—before the case was taken into final consideration by the Government of India—to consider the revised scheme advocated by the Inspector General of Forests. The amendments suggested by Local Governments and Administrations in regard to the Inspector General's scheme, as well as that officer's final proposals, are exhibited in convenient form in the tabular statement appended to this despatch.

We may here explain that the Bombay Government are not at present prepared to submit definite proposals, as the question of reorganizing the subordinate forest establishment in that Presidency is still under consideration by the Local Government, who contemplate the withdrawal of certain portions of the reserved forests from the management of the Forest Department, and are consequently doubtful whether the increase of expenditure proposed in the Inspector General's note of 3rd June 1892 will really be necessary. We do not, however, think it expedient on that account to further delay the final consideration of the question so far as other Governments are concerned.

The proposals as now finally revised have been formulated after very careful consideration of the actual requirements of forest-administration in the several provinces, and have, in our opinion, been framed with as much moderation as is consistent with the efficient protection, improvement, and economic exploitation of our forests. They involve an ultimate total increase of Rs. 4,13,6 88 per annum on account of permanent establishments, and a decrease of Rs. 87,048 under temporary establishments ; or a net increase of Rs. 3,26, 640 per annum. This amount will only be gradually worked up to as trained and suitable men become available ; and it is anticipated that the extra expenditure which will in all provinces, excluding Bombay, be incurred during 1893-94, if your Lordship accords sanction to the scheme, will not exceed the sum of Rs. 1,50,000. In communicating sanction to the scheme, if it is approved, we shall issue orders that its introduction in each province must be so regulated and restricted that the expenditure in connection with it in 1893-94. shall not cause the grant for the Forest expenditure of the province in the year to be exceeded.

Note on the Pests of the Teak Tree.

BY MAJOR C. T. BINGHAM.

At page 46, No. 2, Volume XVIII of the "Indian Forester," there is a note by Mr. J. Nisbet, Deputy Conservator of Forests, on the damage done to the teak plantations in the Pegu Circle by the larva of a moth.

This moth, called by Mr. Nisbet, "*Tortrix* (*Tectonæ* ?)," does not, so far as I know, occur in Tenasserim. During the past three years, while on tour in the forests, I have made careful search and been always on the look out, but have failed to find it. Quite recently also at my request Mr. P. W. Healy, Extra Assistant Conservator of Forests, went the round of the whole of the teak plantations, and over much of the natural forest in the Ataran valley, without coming across a single teak tree attacked by the pset.

As it was a matter of some importance to procure the moth and have it properly identified, on the 23rd April of this year I sent a servant, who has been used to collect insects for me, to Rangoon and by the kind permission of Mr. Jellicoe, Deputy Conservator of Forests, in charge of the Rangoon Forest Division, he was enabled to proceed to the teak plantations in the Magayi reserve, where the plague of caterpillars destructive to the leaves of the teak had set in. This plague, I believe, occurs annually in some portion or another of the Rangoon Division.

Some 50 or 60 larvæ were procured by my man, who returned on the 30th.

Unfortunately, I had been obliged a day or two earlier to go out into the district, and I did not return till the 6th May.

On examining the box containing the caterpillars, which had, according to directions I had left, been looked to daily and fed with fresh teak leaves, I found that the majority had not only pupated, but that a good number of the moths even had issued. Luckily, however, there were still some 12 or 15 remaining in the larval state.

The moths I found were of two species.

One, a soft dark robust-bodied moth, with an expanse of 1·3 inches, has been identified by Mr. Cotes, as a Noctues moth of the family *Hyblæidæ*, species *Hyblæa puera*, Cramer. On the *upper side*, the ground colour of the fore wing is ashy grey with a tinge of yellow shaded at the base of the wing on the disc, along the costa, and broadly along the outer margin with soft dark brown; hind-wing dark brown with an irregular band on the disc not reaching the costa, and a large squarish mark at the anal angle vermilion red. Cilia of the fore-wing dark brown, of hind-wing brown with a light wash of pink. *Underside*, both wings pale vermillon red turning at the base, along the costa and on the disc of the fore-wing to yellow; an irregular mark on the fore-wing and two spots at the anal angle of the hind-wing, with some indistinct shadings dark brown.

The larva measures a little over one inch in length. It is whitish yellow beneath, dusky greenish above. Along the middle of the back is a pale flesh coloured stripe with darker smoky brown stripes one on each side, which latter are each outwardly margined by an indistinct and somewhat interrupted white line. Head dark brown; a few erect dark hairs scattered over each segment.

The second species, Mr. Cotes informs me, is new to the Indian Museum collection, but that it is undoubtedly one of the Pyrales and very close to *Paliga (Scopula) damastesalis*, Walker.

The following is a brief description of the larva and moth.

Larva: length 0.7 to one inch. Colour pale sap-green; two lines of purplish spots along the middle of the back. Head yellow; a few pale erect hairs scattered over each segment.

Moth: expanse 0 9 inches. *Upperside* pearly white with a slight creamy tinge; fore-wing marked along the costal and outer margins and across the disc with spots of red, forming on the last indistinct narrow red cross bands; hind-wing with the outer margin narrowly edged with the same colour. Ciliæ of the fore-wing alternately red and white; of the hind-wing pure white. Underside pearly white.

The larvæ that had not pupated had all turned by the fifth day after my return. Both species seem to take the same length of time over their metamorphosis, the moths issuing from the 8th to the 11th day after pupation.

The *Hyblæa* formed a rather flimsy cocoon either in the corner of the box, or along the mid rib of a leaf, dragging the sides of the leaf slightly together with the web. The *Pyralis* invariably rolled itself up in the edge[1] of the leaf, holding it in position by a few threads.

My recollection (for I unfortunately have mislaid the notes I took) of the ravages of these caterpillars when I was in charge of the Rangoon Division, is that they appeared in the teak plantations on or about the 20th May, sometimes in almost incredible numbers. Their ravages were confined to certain areas, where they re-appeared year after year stripping the young teak of their leaves with the rapidity almost of locusts, and hanging in thousands by webs to the branches of the trees.

It is quite possible that *Hyblæa puera* may, like the *Tortrix murinana* mentioned by Mr. Nisbet in the paper above quoted, pupate among the dead leaves on the ground, but, if so, I should fancy few individuals could survive, for a plantation attacked by these pests is a wonderful scene of activity. Numbers of jungle fowl, ground thrushes (*Pitta*), and insectivorous birds of all kinds crowd to the spot to feed on the caterpillars.

The *Pyralis*, as I have already said, rolls up the edge of a leaf and is thus rendered less conspicuous and saved from enemies. It certainly occurs in far greater numbers than the *Hyblæa puera*.

(INDIAN MUSEUM NOTES.)

MAULMAIN;
18th June 1892.

---

(1) The specimens have since been submitted to Colonel C. Swinhoe, who has kindly examined them and determines the species as *Paliga damastesalis*, Walker.

IV.—REVIEWS.

Reports on Botanical Gardens.

The reports on the Saharunpore and Mussoorie Botanical Gardens, the Horticultural Gardens at Lucknow, and the Gardens and Parks in the Nilgiris, for the year ending 31st March, 1893, have been received. As usual, the report for Saharunpore is the most interesting of the three. The Superintendent of the Gardens will in future look after District Arboriculture, for which he receives a small allowance. It is said that the absence of trained advice is often felt by the District Boards, but why have they never thought of the local Forest Officer who could easily give the benefit of his opinions especially in the rains, when probably most of the planting is done ?

The Jalap plant has been attacked by a disease, and its successful cultivation in the N. W. Himalaya appears to be extremely doubtful. In other respects many interesting experiments have been carried out, and we are glad to see cold water thrown on acclimatised seed, sold to Tommy Atkins at 8 Annas a pound, to produce "peas consisting of straw, tomatos of leaf and stalk, spinach running into flower, beets and carrots without roots, &c." in future only those kinds which do well though acclimatised will be distributed.

In the Lucknow Gardens, some of the Avenue trees have been attacked by fungus, probably arising from old stumps left in the ground, thus shewing the advisability of digging out stumps when old trees are removed to make way for young ones. *Eucalyptus tereticornis* has flourished more than any other species of gum, and the leaves have again been used for engine boilers. These gardens as well as those at Saharunpore very nearly pay their expenses.

The Nilgiri gardens with a favourable season have done very well, and have been maintained in excellent working order. Here the fluid extract from blue gum is used for boilers, and the results will be given in the next report, and the manufacture of Eucalyptus oil is now being undertaken by private persons.

The Cape Forest Reports for 1892.

This volume contains six reports, all of them of considerable interest and recording excellent work done, though as with other Colonial work, we should like to see more attention paid to the establishment of properly demarcated and settled state Reserves even at the cost of a diminution of the valuable planting work effected.

The first Report is that of the Conservator of the Western Circle, whose charge includes also the Cape Peninsula, and the plantations on the Flats, at Worcester and Kluitjes Kraal near Ceres. The Worcester Plantation consists of blue gum and is being worked in coppice for pit props, up to date it has given a surplus profit of £865. It is intended to fill vacancies with *Jarrah* (*Eucalyptus marginata*) which does well. The Kluitjes Kraal plantation of 500 acres has been found to have been too thinly planted and this is now being remedied by interplanting. At the Tokai Plantations on the slopes of Table Mountain, many changes have taken place ; the old Manor House, formerly the Conservetor's residence, has been given up, and the rather desultory sparse planting is been filled up to a proper distance and we are glad to see that greater use is being made of the Pines (*P. Pinaster and P. insignis* especially) which do so well at the Cape. It is also intended to grow the pencil cedar (*Juniperus bermudiana*). The large Tokai nursery supplies large numbers of trees to purchasers for planting in Cape Town and its suburbs and so serves a very useful purpose. On the Cape flats, the chief tree grown is a wattle (*Acacia saligna*) of which great things were expected as a tanning material. These expectations, however, have not been realized, but the firewood seems to sell well.

The Conservator, Mr. D Hutchins, very properly advises more planting in the Cape Town streets and there can be little doubt of the value of his advice. He also recommends wood paving for the streets, and says that in the Knysna forests, tongued and grooved yellow-wood flooring is now being regularly made, as that wood (*Podocarpus*) has proved superior to pine.

We are very glad to see that much attention is being paid to Table Mountain and in our opinion the whole available area on it should be reserved and the tree growth protected by systematic fire-belts, allowed to grow up, being assisted where necessary artificially. On the subject of fires, the Conservator expresses his feelings strongly and picturesquely as follows :—

" It cannot be too often repeated that these fires are the ' direct result of bad Forestry. A clean, dense plantations of oaks, ' and of most other trees, is quite safe from fire. And even in the ' case of Pines, a dense clean plantation runs little risk from fire

'after six or eight years of its existence. But the dirty, irregular,
'and sparse plantations, that are so common on the slopes of the
'Table Mountain, simply invite fires, and are sure to be burnt
'sooner or later. The approximate cause is of little consequence.
'The only result of squandering money on rangers and watchers
'is to postpone the conflagration, and make it worse when it does
'happen. I speak with 20 year's experience of the subject, 10 of
'which relate to India, where forest fires are an evil ot terrible
'magnitude, but one that is successfully met and overcome. But,
'as regards Table Mountain, the subject lies in a nut-shell. It is a
'simple little question of bad Forestry, without even the difficulties
'that occur in the more severe climates of the Knysna forests and
'of the Amatola forests near King William's Town. An owner
'who allows his plantations to degenerate to a jungle of scattered
'trees and rank ground herbage, is a nuisance and a danger to his
'neighbours, and I trust before long will be brought under penal-
'ties similar to the owner of a flock of scabby sheep.

'In the Colony, I have followed the history of the destruction
'of numerous tracts. The story is invariable. It begins with
'irregular fellings that are excessive in certain places. As the
'trees are opened out, herbage and bush cover the once clean
'forest soil, and then come fires. If the evil be not taken in hand
'at once and the burnt patches immediately replanted, they will
'gradually extend until the forest is pushed back to the dense
'kloofs, where it is nearly fire proof, though even here, if axe
'and fire act together as they did in the forests of the Stockenstrom
'division the kloofs will eventually be burnt out. The destruction
'of the Stockenstrom forests went on for many years, the forest
'being all the time under the strict Government Conservancy
'regulations which on the whole were faithfully carried out.
'But it was considered necessary to show a revenue, for which
'wood had to be cut' and the normal capability of the forest was
'exceeded. The natural law by which the dense forest protects
'itself from fire was broken and the inevitable consequence fol-
'lowed."

A commencement has been made in the training of forest officers, and Mr. C. B. McNaughton was sent to Coopers Hill for training and is said to be doing well there.

The Midland Circle Conservator has charge of the great Knysna Forests where the chief tree is 'Stinkwood' (*Oreodaphne bullata*) and work chiefly consists in supplying sleepers for the Government Railways, while improvement works are not neglected, for we see that a large area has been gone over in improvement thinnings in order to free Saplings of Stinkwood and other valuable kinds. Demarcation and survey are also going on and the following description of the demarcation work will be read with interest in this country.

"The boundary lines of the reserves are laid down on the 'ground (except where unnecessary, as along the crests of moun-'tains, &c.) by means of live beacons placed in preference on the 'tops of the ridges that are intersected, so as to be visible from 'each other. Through the forest the clearing of these lines 'becomes a long and tedious operation which costs nearly £10 a 'mile in labor alone. The lines are set out daily or almost daily 'with a theodolite, but a forester is usually competent to produce 'them alone during the intervals between each setting, by means 'of a prismatic compass.

'It is intended to replace those corner beacons of the reserve 'to which materials may be carried by permanent beacons. The 'importance of this work can scarcely by overrated.

'Without substantial beacons, many of the boundary points 'become lost or altered within a few years, and it has been my 'unfortunate experience to find that many of the ordinary proper-'ty surveys within these districts, which appear, from independent 'evidence, to have been made accurately enough, have become 'almost worthless on that account. And a single beacon altered 'tends to throw discredit on the best of work, since, without 'further evidence, it becomes a matter of doubt whether a discre-'pancy may be due to the altered position of a beacon or to in-'accuracy in the previous work. On the other hand, the uniform 'agreement of the positions of these beacons, such as masonry 'beacons which obviously cannot have been tampered with, would 'always establish a strong presumption of the accuracy of the 'recorded positions of other original points.

'Owing to the difficulty that was experienced in getting a 'suitable stone-mason for the work, I was led to adopt beacons 'made of a block of concrete cast *in situ*, normally 2 feet below 'and 2 feet 6 in. above the ground, and 20 in. square at the 'ground level, tapering to 15 in. square at the top, a hole 2 in. 'square being left down the centre for fixing survey signals and to 'serve as a centre mark. The cost is reduced, by dispensing with 'a stone mason at comparatively high wages, and with the 'transport of stone (suitable kinds for breaking up into concrete 'being found nearly everywhere), from about £3 to under '£1-7s.0d. including materials, labour, and transport, and it will be 'probably still less where the beacons required to be built are not 'far apart."

In the Eastern Circle, Mr. J. S. Lister is the Conservator, and his head-quarters are at King William's Town. His Report is interesting, though there is little which requires special note in these pages. And the same is the case with the Report of the Conservator, Mr. Henkel, on the Transkei Circle, one of the most noticeable points in which is the system of giving Free Permits to Kafirs: on this Mr. Henkel writes as follows:—

" As pointed out in the Annual Report for 1891, a very large ' and trained staff is required to watch Natives cutting Wattles, ' poles and kraal bushes under "Free Permits" which have to be ' granted by the Resident Magistrates. Applicants for a Free ' Permit, as a rule, do not proceed to the forests themselves, but ' send boys, often their own sons or relatives, to cut for them. I ' have personally observed that young and valuable timber trees were girdled and partially cut through out of pure mischief by ' these native boys. Young timber so injured blows down during ' strong winds and does a great deal of damage to the forest.

" The Natives are now well acquainted with the different ' species of timber trees, the reserved trees are shown to them by ' the Foresters and Native Forest Guards.

" The heathen Kafir, when he can afford it, marries two or ' three wives, consequently the Bantu race is fast increasing. It ' has been calculated that in 16 years time their numbers will ' have doubled themselves: therefore, if the present system of ' building huts, kraals, &c., &c., is continued, large Wattle plantations will have to be established to supply their requirements, as ' the supply is almost exhausted.

" The civilizing influences of Missionary and Government ' brought upon the native races, have been hitherto of very little ' avail, but if the original plan of Government, of separating locations by belts of farms had been carried out and these sold to ' industrious European farmers, the force of example would have ' been the means of rousing the Natives to energy and thrift."

The value of the Free Permits thus granted by Resident Magistrates during the year, amounted to £15,295 while the collected revenue was only £1,956. The complaint is the same that has been made in Ceylon, and all we can say is that the Bombay Forest Officers have, at any rate, the advantage that the privileges in their forests are fixed and recorded so that they know what to expect; in Transkei, the case seems to be that as fast as the Forest Officers work to raise trees, the magistrate issues permits to cut them down. We suppose that the day for regulation and settlement will come sometime, meantime we congratulate the Cape Forest Officers on their energy and are glad to note a distinct record in this Report of a tendency towards more regular conservancy and more scientific management.

VI.—EXTRACTS, NOTES AND QUERIES.

In the Amador Second-growth Forests.

Amador county is one of the most neglected portions of the Central Sierra region of California. It lies between Calaveras and El Dorado, and extends from the edge of the valley eastward to the summit. In outline it is something like the Isthmus of Tehuantepec, irregular, and narrow in the middle. It is large, thinly populated and very mountainous. Historically it has been one of the most active of the old mining counties. Large quartz mines are in operation there, but the placer mines were long ago exhausted.

A branch railroad extends east from Galt, in Sacramento County, to Lone, in Amador. Stages run to the towns and villages as far as Volcano, about twenty-five miles further east, and 8,000 feet above the sea. At the present time (May 1st), and for six or eight weeks longer, Volcano will be the end of the stage route ; in summer the stages go " to the snow-line." For the trip to Volcano the last of April is probably the pleasantest part of the year, for the roads are not dusty and the weather is delightful, though the nights are still cold—about thirty-degrees at times—so that one needs a heavy overcoat if travelling late.

When Amador was first settled, Yellow pines of great size stood in forests down to the 1,200 feet level, and Sugar pines began to mingle with them at about 1,500 feet. A little higher came the *Libocedrus*, and then the Douglas spruce while the pines continued. The Oaks were also very large and fine. All these earlier trees, except a few Oaks, have been cut down, and the face of the country, except in small scattered clearings, is covered with second growth and coarse bushes of no economic value. All the lumber used by the people comes from forty miles further east. Even there the large trees are nearly gone, except in almost inaccessible gulches. The selling price of rough, averages $ 20·00 per thousand in Jackson, the county-seat, though it is hauled forty miles over steep roads. None of the mills are making much money. Spruce, deodar and pine lumber are rated at about the same price. The mines use a great deal of heavy timber in shafts, drifts, tunnels and buildings. Teamsters are seen bringing down logs sixteen feet long and three feet in diameter to the lumber-yards of the leading mine companies; such a log is worth fifteen or sixteen dollars and hundreds of them may be seen piled up near the mine-shafts.

In some parts of the country there are gulches that are fairly dotted with old tunnels, shafts and dumps. Everywhere there is evidence of immense energies spent upon mines now worked out or abandoned and millions of feet of lumber have been buried underground. The undeveloped resources of the region are very great, and new ledges are being opened every year. It is easy to see where the famous forests of Central Amador have gone, and now the forests of the upper ridges are being used. Although the county is one of the best portions of the Sierras, its available timber-supply has steadily decreased since its settlement. The view of some writers that the timber-supply of the country is increasing seems most ridiculous here.

A great deal of the lumber cut has been taken from Government land. Everybody admits this, but seems to think it hardly right to prevent it. Every saw-mill owns land, of course, but somehow all the accessible Government sections are in second-growth, exactly the same as the sections that have been entered. That tells the story to an unbiassed observer.

The second growth is very beautiful, and even over the larger part of many square miles it is in exactly the condition now that an intelligent forester would like to have it, if he were to take charge of the district. Twenty thousand acres of second-growth Pine (*P. ponderosa* and *P. Lambertiana*) are to be seen from the County road between Clinton and Volcano (about ten miles), that only need thinning and protecting to become in due time as valuable as any forest on the Sierras. There is a great deal more that would repay care, and many thousand acres which are valueless except for timber, but which could be planted. The settlers start fires to destroy brush and under-growth, and improve pasture, and every few years these fires run over large territories, destroying the second-growth pines There are not many sheep and cattle in the region now, but they come up from the valleys later The second-growth pines average five or six inches in diameter, with many small trees struggling in the dense undergrowth of the more treeless slopes of chapparal. (*Garden and Forest.*)

The Chicago Exhibition.

A Communication from America to the Forst and Jagd Zeitung.

The following notes are sent from a fellow forester in America in the hope that some information regarding the Forestery Building and it contents at the Chicago Exhibition may be of interest as containing details and impressions which have not been given elsewhere in the numerous descriptions already printed.

The term "Forestry Exhibition" is, to begin with, misleading ; an "Exhibition of woods" will be a more appropriate term, for this reason that here is no question of implements used in sylviculture, of devices used in practical forestry, of working plans, and of maps, etc : but only of various timbers and of enemies of forest growth. The only exception is in the case of the exhibit of the Prussian Department of agriculture forwarded in charge of a Conservator who was to take opportunity to study the felling and carriage of timber in the natural forests California. But this, the sole technical and sylvicultural exhibit which the Chicago Exhibition possesses, was at the time of our visit still reposing in its travelling case.

The "Forestry Building" stands on the shore of Lake Michigan and is flanked on one side by the exhibit of Leather and in the other by the building devoted to Ethnology. It is a handsome erection, covered in the outside with rough tree trunks, with a high gabled roof, that contrasts well, with its weathered brown color, with most of the other Exhibition buildings ; for these buildings are all white ; the color laid in with brush or to save time with a hose, some inventive American having discovered that it saved time to apply color wash in this comprehensive way.

The interior of the Forestry building is small when compared with the immense halls so frequent in other parts of the Exhibition ; but would be considered large in any other circumstances ; a fact self explantory when it is remembered that space is required for the arrangement of the Exhibits of those numerous States of North, Central and South America that still possess Forests. The number and beauty of the woods exhibited is astonishing ; these are chiefly in the form of blocks 3 to 5 feet long cut from the butt end of the tree and sawn lengthways down the centre ; but planks are also frequently exhibited. As an example of the number of exhibits, the Argentine Republic alone shows 400 different kinds of wood. These American woods are remarkable for their handsome grain and color, and this makes them valuable for cabinet work of all kinds, without considering their good qualities which, as in carriage building, etc, procure for them a good market.

There is also an exhibition of pests and of forest insects ; some fine illustrations of felling and carriage in natural forests ; a few manufactures in wood and bark, and some magnificent wood carvings from New York. Such are the main features of the Forestry Exhibition, showing clearly the money-making characterastics of the American who only interests himself in such wares as can be readily turned into coin, and not in those which serve to maintain the value of the forest to future generations ; to whom, indeed, the idea of the future is incomprehensible.

What we did see of the American forests was not exactly edifying. On the way to Chicago all along the Pennsylvania Line were disforested areas still covered with rotting wood, but the best idea of forest destruction was to be obtained on the North Pacific Railway from St. Paul to Livingstone, where for 1600 Kilometres a treeless prairie stretches, whilst in Yellowstone Park where nature is at its best in grandeur and wildness one may frequently observe large bare areas, evidently originally due to forest fires, and unused, for they have now become desolate wastes. Fires in this National Park are caused by tourists, who during the summer months camp out in this area of 5,600 square miles ; provided with a waggon they wander in the forests camping where they please and supporting themselves by hunting and fishing, for game in the the shape of bears, wolves, wapiti and elk is still common in this tract. Tree vegetation is here not very luxuriant as the elevation is from 7000 to 8000 feet. It is stated as a fact that in the Yellowstone lake which lies at this elevation we can catch trout and at once cook them in the hot springs which are frequent on the shores of this water.

The impression left on us by the condition of forests in America is that this country cannot much longer dispense with systematic forestry such as is carried on in Europe, and that this systematic forestry must be independent of party politics, for the continuity of forest management cannot be guaranteed if the constant change of officials which affects all branches of the administration and originates the constant cry for more money is permitted also to affect the Forest Department of the future.

London Trees.

Before parting with the memorable summertide of 1893, it may not be profitless to observe its effect upon trees, so essential to the beauty and health of the Metropolis. They afford the one redeeming feature to an otherwise ugly town.

Some years ago (writes Sir Herbert Maxwell, M. P., to the *Times*) I brought upon myself a good deal of adverse criticism by quoting Leigh Hunt's saying that it was hard to find a single street in London from some part of which a tree was not visible. I only know of two—*viz.*, Savile Row and a street parallel with Berners Street.

London trees have two adverse influences to resist—coal smoke and heat reflected from miles of brick and stonework. The effect of the latter is so clearly marked upon several species at the present moment that the lesson ought not to be neglected by the Office of Works and by those in charge of squares and gardens, for although the heat has been greatly excessive this year, trees in a town are always exposed to greater summer heat than those in the country.

The trees which have suffered most are one native species—the wych elm—and two exotic species—the horse chestnut and the lime. The condition in which these are now and have been for some weeks past ought to convince us of their unsuitability for urban planting. Many of them are entirely leafless; others retain but a sore remnant of summer clothing.

The plane, for which we shall soon have to borrow the title of a humbler green thing and call it "London pride," has stood the trial fairly well, for, although it has shed half its leaves, the other half remain and are still fresh and verdant. By a popular mistake (pointed out some years ago in the *Garden* newspaper) the tree is called the Western or Occidental plane. It is not so, but an Eastern European and Asiatic species (*Platanus acerifolius*), and may be distinguished from the American *P. occidentalis* by bearing two or more seed vessels on the fruit stalk instead of one.

Aspens and poplars have suffered not at all, and should be more largely planted in London. By a peculiar formation of the leaf stalk, which is flattened midway, they are specially provided with a mechanical means of protection against heat. The leaves hang vertically and possess glands on both surfaces, whereas oak, beech, chestnut, &c., have glands only on the under surface.

But the tree to which Sir Herbert Maxwell calls special attention as invaluable for towns is what is commonly called the acacia. It is not an acacia at all, being of the pea-flower tribe; its scientific name is *Robinia Pseudo-Acacia*. Let any one compare the fine specimen standing at the corner of Lord Sefton's house in Belgrave Square, or a group of young ones in the Green Park, near Wellington Arch, with trees of other kinds around, and he cannot fail to recognise in this species one which, for beauty of form or freshness of verdure, cannot be excelled for planting in towns.

Notes on Tree-seeding.

Mr. A. W. Lushington, District Forest Officer of Kistna writes that this year the Tamarind trees in his District are fruiting abundantly, the crop of last year having been very bad. The *babul sissu* and *Hardwickia* are also seeding well.

Mr. G. G. Minniken, Deputy Conservator in Bashahr, Punjab, writes that "there has not been in this Division for many years 'such a scarcity of deodar seed, while last year the crop was 'unusually plentiful."

The Forestry of the National Reservations in America.

A leading article in 'Garden and Forest' of Aug. 23rd, recommends a staff of military men trained at West Point as being preferable to civilians for the charge of the great national Reserves. The idea is not a bad one, but we do not agree that a technical forest education is unnecessary, and think that if the idea ever were caried out, it would be well to supplement the military teaching by at least two years of technical Forestry.

The Madras Forest Code.

We see in the 'Madras Mail' that Mr. R. C. C Carr of the Civil Service, who has acted, we believe, as Private Secretary to the Governor, has been deputed on special duty to revise the Forest Code of the Presidency, and we are surprised that matters in Madras have reached such a point as this. It seems to be high time for the Secretary of State to interfere again and insist on setting matters right once more Mr. Carr, doubtless, in an excellent officer, but the idea of having a Civilian posted, probably, like the Board of Revenue clerk, at the expense of the Forest Department, to do work which ought to be done by the Conservators, is a serious thing for those who wish well to the Department, and consider its officers quite capable of editing their own Codes.

IIV.-TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

December 4th, 1893.

East Indian Teak.—The deliveries for the first eleven months of this year have been 11,736 loads against a total of 9,401 loads for the same months of 1892, and 13,341 loads for those of 1891. The deliveries in November have been small : 400 loads only, against 967 loads and 1,020 loads in the two previous years. No improvement has taken place in prices, but the tone of the market is more sanguine than it has been of late. Nothing has yet transpired as to the considerable Admiralty requirements tendered for at the end of the month.

Rosewood.—Remains dull of sale, although stocks are not at all heavy.

Satinwood.—There is a moderate demand for figury and large *logs*, but very little enquiry for small, plain, wood ; *planks* and *boards*, are never asked for.

Ebony.—Is more enquired for, but prices have not yet advanced ; there is no stock in first hands.

PRICE CURRENT.

Indian Teak	per load	£9-10s.	to	£15-10s.
Satinwood	,, ton	£5	to	£12
Rosewood	,, ,,	£5	to	£9
Ebony	,, ,,	£5	to	£7

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, December 1893.*)

Cardamoms,	per ℔.	2s.	to	2s.6d.
Croton seeds	per cwt.	20s.	to	27s.6d.
Cutch	,,	20s.	to	23s.
Gum Arabic, Madras	,,	15s.	to	45s.
Gum Kino	,,	£15	to	£18
India Rubber, Assam	per ℔.	107d.	to	2s.3d.
,, Burma	,,	7d.	to	1s.1¼d.
Myrabolams, Bombay	per cwt	9s.6d.	to	11s.3d.
,,	,,	5s.	to	6s.9s.
,, , Godavari	,,	7s.3d.	to	7s.9d.
Nux Vomica, good	,,	6s.	to	8s.
Orchella, Ceylon	,,	22s.	to	28s.
Redwood	per ton	£3.	to	£3-10s.
Sandalwood, logs	,,	£35	to	£55
,, chips	,,	£9	to	£30

Cawnpore Price Current.

December 28th, 1893.

	Per Maund.						
	R.	A.	P.		R.	A.	P.
Aonla fruits—dried	0	12	0	to	0	12	6
„ leaves dried and bruised	1	12	0	to	2	0	0
Babul bark	0	7	0	to	0	8	0
Bahera	1	10	0	to	1	12	0
Stick Lac	20	0	0	to	22	0	0
Myrabolams	3	8	0	to	3	12	0
Moonj grass	0	12	0	to	1	0	0
Babul Gum	12	0	0	to	13	0	0
Mixed Gum	9	0	0	to	10	0	0

THE

INDIAN FORESTER.

Vol XX.] February, 1894 [No. 2.

Utilization of the less valuable Trees.

I desire to draw the attention of the readers of the *Indian Forester* to a large subject, which during my Indian career has often occupied me, I mean the utilization of the less valuable trees, of those which in forest reports are sometimes called *kokat* or common jungle trees.

It will be remembered that the first successful attempts on a large scale, to protect the forests against the annual fires, were made in 18[illegible]5 by Colonel Pearson in the Central Provinces and were continued by Colonel Doveton. The Bori forest, south of the sandstone scarp of the Pachmarhi block in the Satpura range, gave us the first opportunity of seeing the wonderful effect of fire protection. When I visited Bori in company with Captain Doveton in the hot weather of 1869, the forest was a dense and compact mass of luxuriant growth, and the open spaces in it were rapidly filling up with seedlings and coppice shoots. And in Bori, as well as in other forests of the Satpura range, which it was at that time possible to place under efficient protection, this improvement has, I understand, steadily progressed. At the same time we saw what had been anticipated from the beginning, that the less valuable kinds, Terminalia, Anogeissus, Lagerstroemia, Nauclea, Garuga, Boswellia, Odina and the like, were profiting equally with those species that commanded a ready market, that is, with teak, Pterocarpus and bamboo. Similar results have followed efficient protection wherever protection was real and not on paper only. In the plains the common jungle trees, in the hills the inferior pines, multiplied equally with teak, deodar and other paying species. In places with a large fuel demand, such as Darjeeling, Chakrata and others, the inferior woods are sold as firewood or are made into charcoal, and in regions with dry climate, where forests are poor and scanty, and where consequently every stick is valuable, in Sindh and Rajputana, it did not much matter which species were favored by efficient protection. In most forest districts, however, the enormously increased production of the inferior woods threatened to become a real difficulty in the management of efficiently protected forests. Under these circumstances, it will readily be understood that the question of finding employment for those inferior woods has always appeared to me one of paramount importance. In the sal forests, where *Shorea robusta*, the most valuable species, is gregarious, and consequently, as a rule, preponderates over the less valuable kinds, this question fortunately does not arise, the demand for kokat woods being generally sufficient to admit of what I would call uniform working. The same may fortunately be said of the forests of *Hardwickia binata* in Central and Southern India. But even in sal forests it has, I understand, at times been found difficult to dispose of the inferior woods which were cut or which ought to have been cut in improvement fellings. The last issue of the *Indian Forester*, on page 395 of Vol. XIX brings an interesting communication on the extension of wood pavements in Great Britain and the United States, for which purpose jarrah and other Australian timbers have, of late years, been largely imported. The writer justly urges that efforts be made to utilize such Indian timbers for wood paving blocks as have not yet, like teak, an assured and permanent market. As regards the harder kinds of wood, such as *Xylia dolabriformis* and *Terminalia tomentosa*, this is an excellent suggestion.

For the so-called inferior pines of the North West Himalaya their employment as Railway Sleepers and Telegraph poles, after impregnation with zinc chloride, copper sulphate and other antiseptic substances, is an obvious idea, considering the large extent to which impregnated wooden sleepers and telegraph poles are employed in many countries of Europe. Commencing with Dr. J. Warth's excellent paper, which he read at the Forest Conference of 1875, and which was printed in the second volume of the *Indian Forester*, numerous proposals for the impregnation of the Himalayan pines on a large scale have since that time been made, and the writer of these lines has certainly not neglected any opportunities to bring about the establishment of impregnation factories in Northern India. These efforts have failed: the desire on the part of the Engineers to employ iron sleepers was too strong, and the forest interest had no chance. Perhaps this is not to be wondered at, for even in North Germany, the iron sleeper has gained ground steadily and this has mainly been the case because the iron interest is more powerful at the present time than the forest interest.* I would, however, advise my younger friends in India and those Indian foresters whom I do not know personally, but of whose labours I read with interest in official documents, and in the *Indian Forester*, not to lose sight of this idea. Eventually, I feel assured that the impregnation of Himalayan pines and perhaps also of other woods, will come to be an important business in India.

---

*In 1891-92 the total length of single lines on the State Railways of the kingdom of Prussia was 45,620 kil or 29,800 miles. On iron sleepers were laid 11,862 kil or 26 per cent. During the same year, 2,647,801 new sleepers were put down measuring 407,363 cu. metres solid wood, equivalent to 14,391,000 cu. ft. and costing 13,087,478 marks. Thus there is still a good demand for a considerable quantity of second class wood, and, fortunately, a large proportion of these sleepers is beech wood impregnated. The use of iron sleepers, however, has of late years made steady, though slow progress.

It is not impossible that the collection of resin and turpentine from some of the Indian pines may in some forests be the means of utilizing those species, the wood of which in the climate of the plains is not durable. I was glad to see in the Appendix Series, of the *Indian Forester*, a very useful paper upon this subject by Mr. Edgar Thurston.

And it is quite likely that factories of paper pulp may, in course of time, be established on some of the rivers which issue from the North West Himalaya. In many forest regions of Germany, the wood pulp factories established during the last 20 years have had a great and most beneficial effect upon forest management, by creating a steady demand on a large scale and at remunerative rates. Those forest students of Coopers Hill, who were with me on the forest tours between 1888 and 1891 may recollect the large number of wood pulp and cellulose factories in Saxony, in Bavaria, and in the Black Forest. Such factories have been built all over Germany wherever a sufficient supply of spruce and silver fir is readily available. The paper, upon which the "Times" is printed in London, is to a great extent made of cellulose and wood pulp manufactured in the Murg valley of the Black Forest. It will be remembered that about 1878 the paper manufacturers of Great Britain were in despair because the supply of linen rags, and of Esparto grass from Spain and Algiers, seemed quite insufficient to meet the rapidly increasing consumption of paper. A distinguished representation of some of the leading paper mills came to India, armed with strong recommendations from the authorities at home. Bamboo paper pulp was then regarded as the last resourse of the starving paper mills, and it seemed a national duty to make over the Bamboo Forests of Burma to the paper interest. The enthusiasm for bamboo paper, however, was of short duration. Wood pulp and cellulose factories had already been established, the article soon found favor, and the steadily increasing production of that article has entirely set at rest the apprehensions of paper makers in Great Britain. When, in 1890, the ravages of the "Nun" in the Ebersberger Park in South Bavaria necessitated the cutting and sale of 53 million cubic ft. of spruce timber, no difficulty was experienced in selling the first class timber at fair rates owing to the excellent arrangements made by the Bavarian Forest Department, but there would have been serious difficulties regarding the disposal of smaller stuff, if the large cellulose (chemical wood pulp) factory near Mannheim had not purchased nearly the whole of it. Wood-paper pulp in Europe is at present almost exclusively made of spruce and silver fir, but the wood used in the first instance was the Aspen, and it is not impossible, that besides the Indian pines the wood of some broad leaved species may eventually be utilized in this manner.

Iron making with charcoal perhaps offers, in most parts of India, the most promising field for utilizing the surplus wood, which eventually must be the result of efficient protection and good management. The subject has been repeatedly discussed in official and non official publications, but strange to say, no vigorous action seems as yet to have been taken. It is satisfactory, however, that the subject has lately again been prominently brought forward by Mr. Holland is No 8 of the Handbooks of Commercial Products. That portion of India where, in the interests of good forest administration and in the interests of the country generally, it seems most desirable to revive the old native iron industry, is the Madras Presidency, with its unrivalled deposits of rich iron ore and with its absence of mineral coal. When, in my Suggestions regarding Forest Admininistration in the Madras Presidency of 1883, in the Chapter 'Forests and Iron,' and elsewhere, I endeavoured to urge early action in this direction, I hoped that a few years' effective protection of the reserved forests in the Salem and other districts would make it possible to commence operations.

What I have been able to learn from the Annual Reports of the Madras Forest Department, from the *Indian Forester*, and from other sources, has been disappointing. As regards the drier districts, at least, I have looked in vain for evidence that the reserved forests have materially changed their character. I have nowhere seen any indication, that any part of them now forms dense compact masses of forest growth. Mr. Holland, on page 13 of his paper, gives extracts from a special report submitted to the Government of Madras in January 1892. In this report the timber fit for charcoal burning, that may be expected annually from the forests situated within convenient distance of the great iron ore beds in four Taluqs of the Salem district, is estimated at 20,000 tons a year. The area is given for two Taluqs only: *Salem Taluq* 47,800 acres, estimated to yield 5,736 tons a year, or 0·12 tons per acre; and *Uttankarai Taluq* 31,946 acres, estimated to yield 8,140 tons a year, or 0·25 tons per acre. Now, if these figures correctly represent the actual condition of these woodlands, forest management in the Salem district would not seem to have made very great progress since 1883. On page 177 of my Madras Forest Report, may be read a brief account of the Nimayampatti reserve in the North-east corner of the Salem district, on low hills at the foot of the Yelagiris, the standing crop on which, about 12 years old, was estimated at 2½ tons per acre, corresponding to a mean annual yield of 0·2 tons per acre, a very poor yield; the forest, however, had not been protected from fire. The same yield, it was then expected (page 180), might be furnished under effective protection by a railway fuel reserve formed in 1866 and proposed to be extended to 50,000 acres, along the railway line at the foot of the Shevaroy hills. But these were areas with very poor, stony soil. For those reserves in the Salem district, the produce of which would be available for iron making, an annual yield of half a ton per acre was estimated.*

Under the operation of the Madras Forest Act, good progress seems to have been made in the demarcation of reserved forests in the Salem district. Out of 2,578,000 acres of Government unoccupied land, † not less than 487,000 acres had, by 31st March, 1892, been declared reserved forests under the Act. The point, however, is, whether this large area or part of it has been protected efficiently. Looking to the figures quoted above, this seems to be open to doubt. If indiscriminate grazing and cutting is permitted, it cannot be expected that the condition and production of forests will improve. Certainly, one of the objects in forming reserved forests in the Madras Presidency is to provide for the agricultural population in the vicinity a permanent source of supply of fuel, bamboos and building wood, and of cattle fodder, as far as this is compatible with the rational management of the forests. It does not, however, follow that for this purpose the whole area must be thrown open to grazing and cutting. Selected blocks ought to be completely closed against grazing, and against cutting, as far as such may not be necessary in the interests of the forest, at least during a time sufficiently long to ascertain the capabilities of the woods thus treated.

At this time, ten years after the passing of the Madras Forest Act, which is acknowledged to be a useful enactment and one that meets the requirements of the case, and after the establishment of an organization, which is now generally admitted was a good one ; in the Salem district, at least, to all appearances no real progress has been made in the one essential condition of success in forestry, the determination of the annual yield of woodlands in different localities under efficient protection and under a good system of management.

As regards the Iron question, no operations on a large scale can be undertaken, unless the annual yield of the available forests is determined, and this was the first step which I urged should be taken in this matter. The second step was not to let the existing Native iron industry die out for want of fuel. Then two measures, the necessity of which I endeavoured to urge in my Report, are as necessary now, as they were in 1883. Certain carefully selected areas must be set apart and must not be touched, except where thinnings and improvement cuttings must be made. But, outside these selected areas, such arrangements must be devised, as will enable existing native iron works to obtain the necessary fuel for their operations. The proposals of my Madras Report, however, went further. I explained that if it were decided to leave the commencement of iron making operations on a large scale with improved methods to private enterprize, action must be delayed, until a sufficient area of forest had for some time been efficiently protected, and had attained a condition in which the required yield per acre could with certainty be depended upon as a permanency. My recommendation, however, was different. I urged that operations should be started on Government account for the improvement of the native method. I suggested that an attempt might be made, gradually to improve the native process in the direction of making it less wasteful, by introducing the indirect process and employing blast furnaces of a moderate size, so constructed and arranged, that native workmen could keep them going. This idea was originally started by Dr. Warth, in a paper which he wrote in 1881, on "Iron making in India." At the same time, I submitted that this would require a metallurgist, practically conversant with charcoal iron making, to be attached for a time to the Forest Department of the Madras Presidency. This has not been done. It is not for me to consider, whether the importance of maintaining and gradually improving the native iron industry has been sufficiently recognized by the Government of the Presidency. The subject has doubtless received due consideration, for, quite apart from the forest question, the interests of those classes and tribes in the different districts of the Presidency, which formerly depended upon iron making, seem to demand earnest consideration.

---

*Madras Report, p. 184. † Madras Report, p. 272.

However this may be, my advice to the forest officers in those districts, where the old native iron industry has not yet been extinguished, is to devise means to prevent its extinction, and secondly to endeavour to introduce such improvements in the native methods of iron making, as will ensure greater economy of fuel. Ball, in his Economic Geology of India, gives some data showing the great waste of charcoal in this process. On page 351, he draws attention to the excellent account given by Dr. Buchanan of iron smelting in Malabar, which he visited in December 1800, and where, in order to produce from 256 to 324 ℔s of malleable iron, 1,890℔s of charcoal were used, which is about 6 times the weight of the iron obtained (Journey, Vol. II, page 438). On page 384, Ball describes the process in the Jabalpur district, where one maund of wrought iron requires, in the first instance, 6 maunds of charcoal to make kachcha iron, and then 4 maunds of bamboo charcoal for refining. And, on page 341, he states that in some cases the consumption of charcoal fuel for the production of finished iron is as 14 tons of the former to 1 ton of the latter.

It may be urged, that it is hopeless to effect any improvement and to introduce economy of fuel in the place of the present wasteful native method, considering the failures of the numerous attempts made in the Madras Presidency and in other parts of India, to establish a remunerative charcoal iron industry with improved methods. The discontinuance of operations at Porto Novo, Beypore, Trinomalai and Pulampatti, in Nimar, at Dechauri below

Naini Tal, in the Jubbulpore district and elsewhere, are certainly disheartening, but in none of these undertakings has the forest question been dealt with in the right manner. At the risk of being tedious and of saying things which each Indian forester knows, as well as I can explain them, I would urge once more, that the most promising tracts should be selected for the experiment in the first instance, tracts which, if properly treated, will produce a heavy annual yield. Even in Europe, there are very great differences in the annual yield of forests stocked with the same species. The spruce woods of the Ebersberger Park in Southern Bavaria, had, before they were attacked by the Nun, an annual yield of 50,. while those of Weingarten in Southern Württemberg produced 100 cubic feet per acre. Whether the splendid Eucalyptus plantations on the Nilgiris and the Casuarina plantations in the plains have since 1883 been steadily extended and properly managed, I have no means of knowing ; in those days I had good grounds for expecting, that over large areas, the former would yield annually 6 tons, and the latter 2 to 6 tons an acre. If large areas producing timber at these rates were available, it might pay to carry the more valuable iron ores to the places where the charcoal is produced. But all these are matters of detail, which must be settled on the spot, by persons acquainted with the actual condition of things at the present time.

In Europe, the employment of charcoal for iron smelting has within the last 60 to 80 years greatly diminished, mineral coal being now almost universally employed. Vast areas of beech forests, the produce of which formerly found remunerative employment in iron smelting. have to a great extent lost their value by this change, and it is in many instances difficult to dispose of their produce. There is a certain analogy between the beech in Germany and the inferior woods in India. The increased production of mineral coal has greatly diminished the use of beech wood as fuel, and has, in many districts, extinguished its use for iron smelting. An extensive area stocked with magnificent beech woods, called the Kermeter forest, situated in a bend of the river Roer, which some of the Coopers Hill forest students may remember, runs at the foot of the Hohe Venn and lower down, passes alongside the Hambach forest range near Jülich, formerly produced the charcoal consumed by a number of large iron works in the Schleiden valley. In those days, every stick produced here was utilized, and most of it was converted into charcoal made in large kilns which were established in the vicinity of the annual cuttings. About 40 years ago, the competition of iron made with mineral coal in other parts of Rhenish Prussia, became so severe, that the iron works in the Schleiden valley were gradually closed. Some of them have resumed operations, but are now working with coke brought from a great distance. In the Siegen country, the excellent ores found there, mostly spathic iron, were formerly smelted with charcoal, mostly oak, the produce of the extensive coppice woods (*Hauberge*), which some of those Coopers Hill men, who accompanied me in 1888 and 1889, may perhaps remember. Here the Iron industry is as flourishing as ever, indeed it has latterly been developed on a very large scale. But mineral coal, which is brought from the coal districts near the Ruhr valley, has taken the place of charcoal. Changes of a similar kind have come about in England. The charcoal made of the Dean forest beech wood, was at the beginning of this century used in the iron works of the neighborhood, until it was replaced by the coal which was found underground in that forest.

Iron made with charcoal, however, has qualities which render it almost indispensable for certain purposes, hence the maintenance of charcoal iron works in Sweden, in Austria, and in some parts of Germany.

Some the Coopers Hill men may perhaps remember the large works at Jenbach in the Inn valley below Innspruck, which we visited in 1889. In Rhenish Prussia there are seven charcoal iron works, one (Jünkerath) in the Eifel mountain range, the other six in the country on the headwaters of the Sieg and the Lahn rivers. In 1892 these works employed 1024 men ; the ore worked up by them that year amounted to 33,308 tons, to which were added 2,082 tons of limestone, and they produced 16,834 tons of pig iron. The largest work, Müsen in the Siegen country, made 5,317 tons during the year. In one of these works situated near Dillenburg, 850 to 900 lbs of charcoal was used to make 1,000 lbs. of pig. The direct process of making wrought iron, which is the old native Indian process, has now everywhere been abandoned in Germany. It was nearly as wasteful as the Indian process, 100lbs. iron requiring from 300 to 800 lbs. charcoal. This, however, it must be remembered, was wrought iron.

A singular confusion would seem to exist in the minds of some writers upon this subject in India. Thus, a writer in the *Pioneer* of 20th March 1893, quoted in the *Indian Forester* of September last (page 340) places Dr. Schlich's estimate of 2¼ tons of charcoal required to produce one ton of iron against that given in my Madras Forest Report (page 57) *viz.*, 3½ tons. But Dr. Schlich, writing of the Barwai iron works in Nimar, spoke of pig iron (15 tons a day or say 5,400 tons a year) requiring 372,604 maunds of charcoal ; whereas I spoke of finished, or wrought iron. The same writer states that in the Blandfer furnace 16¾ cwts. of charcoal were used for one ton of pig. This is about the quantity at the present time used in Germany. The quantity of charcoal required, varies with the construction and management of the furnace, the temperature of the blast, and many other circumstances : among others, the nature of the ore and the quality of the charcoal. Assuming that, under good management and with the best modern appliances, one ton of pig iron would require one ton of charcoal, an annual outturn of 10,000 tons would demand 10,000 tons of charcoal, corresponding to 40,000 tons of wood. This, however, is pig iron, which, on conversion, gives a smaller quantity of wrought iron or steel. Without entering into details regarding the fuel required for this process of conversion, which varies within very wide limits, it may be assumed that under favorable circumstances, and with the best modern appliances, 20,000 tons of charcoal may, by the indirect process, be made to produce 10,000 tons of wrought iron or steel bars. In 1883, the data then before me did not seem to justify so favorable an estimate, and I was right in assuming that 25,000 tons of charcoal would be required to make 10,000 tons of finished iron.

Regarding the area required to produce this quantity, there must be more data available now than I had been able to collect in 1883. I have, however, looked for them in vain in the Annual Reports, as well as in the pages of the *Indian Forester*. In 1883, I had before me the excellent valuation surveys made by Mr. Hutchins of the Casuarina plantations in the plains and of the Blue gum woods on the Nilgiris, as well as estimates which I had made of other woods on my journeys through Southern India. It has already been mentioned, that those data seemed to justify the assumption, that, while in the moist climate of the hills and on the sea coast, blue gum and Casuarina, if planted on a large scale, might yield, the one 6 tons, the others from 2 to 6 tons a year per acre, the woods in the plains at the bottom of moist valleys might yield 2 tons but that the yield of the whole of the tracts available for the production of charcoal would only amount to half a ton per acre. Beech woods in Germany, completely stocked, and well managed, have the following yield per acre on a rotation of 100 years, the produce of thinnings being included and all wood being reckoned down to 3 inches diameter.

Locality I	class	8·7	Cub. M. per hect.	or	124	cub. ft. per acre
III	,,	5·2	,,	,, ,,	74	,,
V	,,	2·2	,,	,, ,,	31	,,

corresponding to about 2½, 1½ and 3-10th tons per acre. Without any certain data regarding the annual timber yield under real protection, of the woodlands available to yield charcoal for iron works in the Salem district, it is useless to speculate upon the area required to yield 20,000 tons of charcoal a year corresponding to my 80,000 tons of timber.

It cannot, of course, be expected that the forest officers of the Salem and other districts in the Madras Presidency should possess that knowledge of metallurgical processes, theoretical and practical, which would enable them to teach native iron smelters economy in fuel.

The circumstance that the proposal submitted in my Madras Report, to associate with the forest officers in this business, a Metallurgist with practical knowledge of charcoal iron making, has not been acted upon, should not, however, prevent action being taken as far as possible. My advice to all forest officers is to endeavour to do as much in this direction as possible and for this purpose to seek the advice and assistance of the officers of the Geological Survey, and of others competent to help them in this matter.

The question has already been raised, whether the importance of preventing the extinction of the native iron industry is sufficiently recognized. Howsoever this may be, eventually it is sure to be regarded as a matter of great moment, and those forest officers who have had the wisdom and energy to take action beforehand, will then reap the benefit of their foresight. These remarks must not be held to be limited to the Salem district. On page 151 of my Madras Report will be found an account of the iron industry in that portion of Bellary which surrounds the Sandur hills. At the time of my visit, in December 1881, 41 furnaces were at work in this portion of the district. A notice in Watt's Dictionary of Economic products, Vol. IV page 506 (1890) says that the native iron industry in the Bellary district had become nearly extinct. Should this really be the case, it would be a fact much to be regretted. From Ball's Economic Geology and from Mr. Holland's paper quoted above, it is evident that there is hardly a district in the Presidency without considerable deposits of workable iron ore. And in other parts of India there is abundance of rich and pure iron ore in many places. The remarks here submitted more or less apply to all provinces.

I must claim the patience of my readers for yet another project for turning to useful account the wood of the less valuable trees in India. Some of those old Coopers Hill Forest Students, who accompanied me on the Forest tour of 1888, may perhaps remember that on our way from the Spessart to Aschaffenburg we visited a large factory at Laupach, where beech wood is subjected to destructive distillation, the produce being charcoal and empyreumatic substances, chiefly acetate of lime and lead. This factory consumes 5,000 cubic metres (stacked) of beech wood annually and thus is a valuable customer for a portion, at least, of the immense quantities of beech wood annually produced in the Spessart. Besides acetates, there are other products of the destructive distillation of wood in retorts and close ovens, which have a certain market value, and which may, perhaps, some day lead to the establishment of such factories in India. A cubic metre stacked of beech wood, air dry, which weighs 500 kilo. (35 cubic feet, weighing 1,100 ℔s.) if carefully treated in retorts, yields the following products :—

1. Charcoal	100 kilo or	220 ℔s.
2. Pyroligneous acid, which, by the addition of chalk is converted into grey calcium acetate	25 „ „	55 „
3. Wood Naphtha (Wood Alcohol)	5 „ „	11 „
4. Wood Tar	15 „ „	33 „

The rest, less the weight of chalk added to make calcium acetate (2), consists of water and gaseous products.

Grey calcium acetate is used in dyeing and to manufacture other acetates mostly used for the same purpose. The present market price of this article delivered at a seaport in Germany is 18 to 22 marks for 100 kilos. Wood Naphtha is used for dissolving resins and for other purposes. Under good arrangements the fluid obtained by the process contains, in 100 volumes, 90 Methyl Alcohol 100 per cent, and the present market value of Methyl Alcohol thus obtained is 80 to 90 marks for 100 kilos. What here is called 100 per cent Methyl Alcohol, contains 80 per cent of the pure substance CH_3 (OH) mixed with about 10 per cent Aceton (CH_3. CO. CH_3) and 10 per cent of various other substances. These two substances will probably in India command a similar market price as in Germany. That mentioned under No. 4, wood tar, is likely to acquire special value in India. By the distillation of wood tar more pyroligneous acid is obtained, and from 35 to 40 per cent of wood-tar oil, a substance with powerful antiseptic properties. This wood-tar oil would, in the opinion of persons competent to judge, be an excellent article for impregnating woods in India, so as to make them durable, that is to protect them against decay and the attack of insects. Wood Tar oil contains the true creosote originally so called, because it was used to preserve meat. What is now generally called creosote is a different substance, the correct name of which is Phenol C^6 H (OH) or Carbolic acid. It is prepared from Coal Tar and is the substance used to impregnate timber in Europe. In the creosoted sleepers, which are imported into India, phenol is the antiseptic substance. Wood tar oil has also been used with success for impregnating timber in Europe. Indian mineral coal is, I understand, not sufficiently bituminous to yield phenol on a large scale, hence, in order to impregnate timber in India with the so called creosote, this substance would have to be imported from Europe. It might possibly be more economical to employ wood tar oil, which contains the true creosote.

In Germany similar results are obtained from the wood of oak and birch, that of oak yielding a little more wood naphtha and pyroligneous acid. The wood of coniferous trees on the other hand, spruce, silver fir and Scotch pine, yield equal quantities of charcoal and wood tar, but much less pyroligneous acid and wood naphtha. It is probable that similar results will be obtained in India, and that, as far as pyroligneous acid and wood naphtha are concerned, the destructive distillation of the wood of broad leaved trees will be more profitable than that of the so-called inferior pines. I would, however, draw special attention to wood tar oil for the impregnation of timber. On the assumption that, broadly speaking, Indian woods will yield the same quantity of wood tar as is obtained by the destructive distillation of beech wood, 1,000 ℔s of timber may be expected to yield 12 ℔s tar oil, a substance which can be used for impregnating the wood of the less valuable pines of the Himalaya.

I have before mentioned the utilization of some of the beech wood of the Spessart hills, through the operations of the factory at Laupach. In old days, the beech wood was utilized in a much more simple manner. The oak timber of the Spessart has from time immemorial found a market in the manufacture of staves for wine casks required for the wine districts in the Rhine and Main valleys. In those days no roads existed in those hills, the oak staves were split on the spot and were carried on mules or on men's backs. In most places, beech was then, as it is now, associated with the oak, and to this mixture the splendid growth of the oak on the poor sandstone soil and in the severe climate of the Spessart must be ascribed. Utilization of the beech timber by export was out of the question ; it was however utilized on the spot on a very large scale by glass factories and for the preparation of potash. The procedure certainly was most wasteful. The beech trees were burnt, glass was made with this potash and the sand, which here was everywhere found on the spot. Where the forest in one locality was exhausted, the glass works were shifted to another place, and the work of destruction was commenced afresh. It was a system which somewhat resembled the shifting settlements of Karen *Toungya* cultivators : and the denudation of the soil, the result of this forest destruction, has, together with long continued practice of removing litter from the ground, had the effect of impairing the productiveness of the soil, particularly on the outskirts of the Spessart and in the northern more densely inhabited portion. To some extent, however, this wasteful system gave room to the oak and thus contributed to the maintenance of this, the more valuable tree in the Spessart, the only one, the timber of which paid for carriage over great distances and hilly ground in the absence of the present splendid system of roads.

What I have permitted myself in the preceding pages to set before my younger friends in India, will enable them to understand why, on the autumn forest tours which I had the honour of making with the senior Coopers Hill forest students, I made a point of showing them, not only the Laupach factory here mentioned, but also the establishments for impregnating timber with antiseptic substances at Zurich and elsewhere, the wood pulp and cellulose factories in the Black Forest and the large charcoal iron works at Lenbach in the Tirol. For a forester in India, a knowledge of chemistry is even more necessary than for a forester in Europe. All these proposals for utilizing the less valuable kinds of timber are based upon processes of a chemical nature, and though it cannot, of course, be expected, that the forester should be competent to establish factories like those mentioned, he ought to be sufficiently familiar with chemistry, to form a judgment regarding the expediency of establishing work of that character in any given locality. The subject which in German Forest Schools is taught under the name of "*Förstlich-Chemische Technologie*" is even of greater importance for Indian foresters than for those employed in Germany

Those who were in the Indian Forest Service in 1878, when I succeeded in getting the Dehra Dún Forest School established, may perhaps know, that the School was established in the teeth of long continued and powerful opposition. In the end, its establishment was only sanctioned on my assurance that the expense of the school would be covered by the increased income which would result from the more efficient management of the School forests. Yet under those difficult and straightened circumstances, I thought it right to insist upon the establishment of a Chemical Laboratory at the School, so as to enable students to become familiar with certain branches of Chemistry in a practical manner, by working with their own hands. Circumstances, I understand, have put an end to this most useful arrangement. This, I think, is to be regretted, because chemical analysis, more than almost any other occupation, is calculated to sharpen the powers of olservation, and to develope the habit of drawing conclusions from observed facts. Chemistry, apart from its showing the way towards a more profitable utilization of woods, which cannot be advantageously employed in construction or otherwise, is an excellent preparation for all practical pursuits which are based upon natural sciences, Forestry among the rest.

But to return to the utilization of the less valuable species. I am a little afraid, lest my anticipation of an inconveniently superabundant production of these trees through efficient protection of the forests, particularly against fire, may not have been altogether premature. I fear it is a fact, that the difficulty of utilizing the less valuable woods has not as yet been felt to the extent which I anticipated, when the effect of fire conservancy made itself felt in the Central Provinces, in North Western India and in Burma. And I apprehend, that the conclusion I must draw is, that improvement in the condition of the forests has not progressed as rapidly as I had anticipated. Should this be the case, then some of the suggestions which I have submitted in this paper, must wait, until a portion at least of the reserved forests have grown into compact and dense masses of wood.

I have before drawn attention to the analogy existing between the less valuable woods in India and the beech in Germany. Fortunately, it is now an accepted rule of sylviculture, in Prussia, in Bavaria and in other States of Germany, that when beech forests are regenerated, a proportion of other more valuable trees must be introduced ; and that, where this practice already exists, the proportion of the more valuable kinds must be increased. Acting upon this principle, the oak, and in places the ash and maple, are sown or planted, where climate soil and other circumstances are favorable. Where this is not the case, conifers, the larch, the spruce, the silver fir and the Scotch pines are introduced. For maintaining the productiveness of the soil, the beech is most useful, but the money yield of the extensive beech forests in Germany is diminishing and this it is desired to prevent by associating with the beech some of the more valuable species. It goes without saying, that in India also the aim must be to incease the area stocked with teak, deodar and other valuable trees, where circumstances may permit of this being done.

The last remark I can imagine, may possibly be the only one that will commend the assent of some of those, who have had the patience to read this, I regret to confess, lengthy paper. Replace the inferior woods by those which are valuable, this I hear my critics exclaim, is the only sound and practical plan to follow.— Eradicate and extinguish the inferior woods and replace them by teak, deodar and other valuable kinds, is, however, easier said than done. And were it done, were pure teak forest, for instance, raised without bamboos and other companions, which tend to favour the growth of teak, as beech or silver fir favour the growth of the oak, the result would not be satisfactory.

Others again I hear object, that the questions here raised are altogether premature ; that under existing circumstances in India, the reserved forests cannot possibly form dense compartments like the forests in Europe ; that though fires are excluded, cattle keep down the young growth ; and that with the increasing population in the vicinity of the forests, uncontrolled cutting and lopping continues as heretofore. To this, I reply that the key stone of forest policy in India, concentration of efforts upon limited areas, seems somewhat to have been lost sight of. I have no doubt that there are, in every division, nay, perhaps, in every range, blocks which can not only be protected against fire, but can be closed completely against cattle and irregular cutting. The improvement which is sure to take place in these blocks, will pave the way for the good management of the remainder. If this principle is generally acknowledged and steadily acted upon, the question of utilizing the inferior kinds must sooner or later arise, and it can only be dealt with by action in the direction here indicated.

So far, some of my readers may go with me, but they are startled by the hint, that in these matters, it is for forest officers to take the initiative. They would prefer to wait, until they received distinct instructions from government, to arrange for the supply of wood, so as to prevent the extinction of the native iron industry, to establish factories for the manufacture of wood alcohol, calcium acetate and wood tar oil, to make wood pulp and to arrange for the impregnation of the inferior pines. Perhaps I may be able to set at rest the doubts of some of these anxious minds by mentioning a few facts from my own experience in the Indian public services, which tend to show, that under certain circumstances, it is the duty of a public officer to stick to a certain line of action, as far as such is compatible with the obedience, which every public servant owes to the Government he serves. Such firmness, however, is only justified by the conviction that the line of action maintained by him will promote the prosperity of the country and will secure the well being of its inhabitants. And, as a matter of course, success in such cases is impossible, where the line of action is dictated by selfish motives.

Soon after landing at Calcutta in December 1855, I had the honor of explaining to Lord Dalhousie, the then Governor-General, the outlines of the first measures which I proposed to take in order to place the management of the Pegu Teak Forests upon a permanent footing. He listened with great attention, and when I had concluded, he fixed me with his piercing eyes and said :— "Dr. Brandis, if you succeed in carrying out these excellent plans, 'you will confer a lasting benefit upon the people of Pegu. I hope 'you may succeed, and you will have my full support in the 'matter. I hold it to be the duty of the Government of India, to 'preserve the forest resources of Pegu, and not to allow them to be 'wasted, as the forest resources of other provinces have been wasted. 'Unfortunately, I must leave India soon, but I trust that my 'successors will take the same view as myself of the Pegu forests. 'Should it, however, thus happen, that at any time the Government 'of India were not fully alive to the necessity of preserving the 'forest resources of Pegu, I hope that you will remember what I 'have told you." Lord Dalhousie left India in March, 1856, and died in 1860.

The measures which, under the orders of Major, afterwards Sir Arthur Phayre, I introduced in Pegu, gained for me the confidence of the Karen and other inhabitants of the forests, for I gave them profitable employment under Government in the working of the forests, and thus made them my allies instead of enemies in regard to forest protection. The merchants of Rangoon, on the other hand, soon commenced a vigorous opposition against the system introduced by me. Personally, I made a point of keeping on good terms with them, and they tried hard to persuade me to allow them to cut the mature timber standing in the forests. With much show of reason they contended, that ships built of wood would soon be a thing of the past, that iron would, in ship building, as well as for all other purposes, replace the use of wood. At that time, the Sepoy mutiny of 1857 had saddled the Government of India with an enormous debt, and the disturbed state of the country had diminished the revenue from many sources. Under these circumstances, my friends urged that the only proper course was to take advantage of the high market rates of teak then ruling and by the sale to them of all the mature standing teak timber, to realize large sums, and thus to create an immediate source of revenue. More than this, the impulse which a business transacted on so large a scale would give to the prosperity of Rangoon imperatively demanded the acceptance of their proposals. They appealed to my devotion to the interests of the Government which I was serving, to my ambition and to my common sense, and they pictured in the darkest shade the disastrous consequences of a refusal to back their proposals Within a few years the demand for teak would diminish, prices would fall, and in the end teak would be a drug in the market and the teak forests would be valueless.

When my friends found that I remained firm, and that Major Phayre, the Commissioner, refused to yield to their representation, they went to Calcutta, and, backed by the influence of the large and powerful mercantile firms of Calcutta, they succeeded in inducing the Government of India to order the Commissioner to throw open the Pegu forests to private enterprize. The orders were sent to Rangoon in February, 1861 These orders had to be carried out, but fortunately we were not required to throw open the whole of the forests at the same time. Nor were we required to make arrangements for more than a limited number of years. By that time, incessant hard work from 1856 to 1861 in examining the forests by means of linear valuation surveys, and by constant height measurements, had taught me which districts were valuable, and which were less so, and this knowledge enabled us, the Commissioner and myself, to frame a good plan of operations. The forests west of the Irawaddi river which, though very extensive, were the least valuable, were given upon 12 years' leases with the permission to girdle. In the eastern Prome forests, those on the Hline river in the Rangoon district and those of the Sitang valley, permits, in some cases for 3, in others for 6 years, were given to cut the timber girdled by the forest officers, so that the power over the green standing trees was reserved to Government. The forests on the Zamayee and Paunglin areas and those in the Tharawadi district, which were the most valuable, were for a time retained in the hands of Government.

In November, 1861, the proceedings of the Government of India were reported to the India office. Here a different view of the matter was taken, and the disastrous effect which these measures must have upon the forests was at once recognised. In a remarkable despatch of 24th March, 1862, which is published in a Parliamentary Blue Book on East India Forest conservancy of 1871, the Government of India was requested to reconsider matters. Thus the Tharawaddi and Zamayee forests remained in the hands of Government. In the other forests, the leases and permits, which had been given in 1861, had of course to run their course, and in some instances they were afterwards renewed, but in the end the whole of the forest came back under the control of the Forest Department.

The wording of the permits, under which the Sitang and other forests were made over to the large mercantile firms of Rangoon, had been framed with the greatest care, yet the foresters employed by the permit holders commenced girdling and cutting green trees on a large scale. This necessitated legal proceedings, which led to the discontinuance of the system. In my Report on Forest Administration of British Burma for 1861-62 page 37, after giving a brief account of the action taken in obedience to the orders of Government, I had justly observed, that the conservancy of forests under the permit system is secured by written documents only, while in forests, worked on Government account, the forest department remains in actual possession.

It is the peculiarity of forest management, that trees require a long time to come to maturity, and this circumstance imposes upon foresters the duty of looking ahead, and carefully considering the future prospects of their charge. Upon them, therefore, in the first instance, devolves the duty of taking the initiative in all important matters, as far as such may be compatible with that loyal obedience which they owe to the Government they are serving. What I have here related concerning the first period of my public career in India, may, perhaps, serve to illustrate what I meant to impress upon those foresters in India, who have at heart the progress of the magnificent British Indian Empire and the well being of its inhabitants.

D. BRANDIS.

The Hill Forests of Java.

(*A translation from the Först und Jagd Zeitung.*)

These forests may be conveniently sub-divided as follows :—

1. The moist forest between 2.000 and 5,000 feet elevation.

2. The forest in the cloudy region between 5,000 and 8,000 feet elevation.

3. The vegetation on the summits of the mountains over 8,000 feet elevation. These headings will be again sub-divided, if necessary, by the position of the forest in East or West Java.

(1.) THE FORESTS BETWEEN 2,000 AND 5,000 FEET.

The forests at an elevation of from 2,000 to 5,000 feet are those in which the rainfall, at least during the north-west monsoon, is greatest. Above 6,000 feet, the moisture-laden winds do not blow, and at 5,000 their effect is much reduced, although occasionally the highest peaks are hidden in clouds. The virgin forest, which originally covered this region, has been already seriously interfered with ; at the lower elevations, coffee is grown and in the higher localities cinchona is cultivated, but in places types of the natural forest may still be seen. The moist forests of Java contain the largest tropical growth, it is here that a luxurious vegetation is enabled to flourish owing to the advantages both in moisture and in temperature In comparison with the forests of Europe, the density is less and this is accounted for by the excessive production of foliage in contradistinction to that of timber ; climbers which, of all forms of vegetation, are the most dependent on heavy rainfall, attain enormous dimensions and seriously affect the density of the forest. But even the trees themselves bear the impress of excessive moisture in the peculiar buttresses, which are absent in the drier regions, but may be taken as characteristic of the forest growth where heavy rainfall is the rule. Epiphytes also, which are common in this region both as shrubs and trees, chiefly Ferns, *Medinilla*, *Fagraea*, *Sciadophyllum*, and *Rhododendron*, are a form of vegetation which cannot exist without moisture ; and finally, the size of the leaves is dependent on the quantity of moisture for in no other region are the leaves so large as in this moist zone, although they do not attain such remarkable dimensions as in the damp forests of the Brazilian coasts.

The forests in the moist zone contain both the true tropical species which are common throughout the island and the more temperate species such as *Amentaceæ*, Conifers, *Laurineæ*, and *Ericaceæ* ; but these latter are generally found only in the more elevated portions of the zone. *Altingia excelsa*, with a stem of often 100 feet high, towers above the other forest growth, with its branches hung with moss and adorned with the crimson flowers of *Rhododendron javanicum*. The more common *Gordonia Wallichii*, though a smaller tree, is no less striking on account of its constantly renewed large white blossoms which remind one of the tea flower. The various species of fig, recognizable from their aerial roots, are frequent in this region ; as well as other trees which, similar to some kinds of fig, bear blossom and fruit on their stems. The *Meliaceæ*, *Magnoliaceæ* and *Anonaceæ*, the last two being chiefly represented by climbers, show this peculiarity in flowering. The observer, however, cannot always without felling the trees determine with any great accuracy the nature of the leaf canopy ; but it is believed that the highest trees of this region belong to the following species, Ferns, *Canarium*, *Thespesia*, *Dipterocarpus*, *Epicharis*. The smaller species are much more numerous and belong principally to the families *Myristicaceæ*, *Tiliaceæ*, *Sapotaceæ Rubiaceæ*, *Euphorbiaceæ*, *Byttneriaceæ*, *Lauraceæ*, *Mimoseæ*. The numerous climbers are as difficult to identify as the trees unless they have some characteristic such as the oval excresences of *Vitis pubifera*, or the thorny hooks of *Uncaria*, or the stem blossoms of various *Anonaceæ and Magnoliaceæ*. Of Epiphytes, the larger varieties have already been mentioned ; of the smaller are orchids and *Aeschynanthus* especially common, as well as ferns, *Asplenium*, *Platycerium*, etc, and *Lycopodia* ; the last often hanging from the branches in festoons over 3 feet long.

But the epiphytic vegetation is not so rich in Java as in Brazil or in the Antilles owing chiefly to the absence of *Bromeliaceæ*. The dense undergrowth comprises a bewildering admixture of species ; *Urticaceæ*, *Piperaceæ Myrsineæ* are very numerous but not otherwise remarkable ; but the coral red inflorescence of many bushy shrubs of *Pavetta* strikes the eye at once, as well as the orange flowers and large white calyx of the *Mussænda*. Other Rubiaceæ, like the violet flowered *Lasianthus*, are distinguished by the disgusting odour given out when the leaves are bruised. There are a few small palms (*Pinanga*) and tree ferns (*Alsophila*). But the most remarkable part of the undergrowth consists of giant monocotyledons (*Musa*) which are never found in flower or fruit ; besides *Zingiberaceæ* (*Alpinia*, *Elettaria*, *Costus*, *Zingiber*, *Hedychium*, *etc.*) These species of *Zingiberaceæ* which frequently attain a height of 12 or 15 feet, form small clumps under which few other species can exist. Between the dead leaves which cover the ground may be seen the red and yellow inflorescense of *Costus globulus* and various kinds of *Elettaria* ; other similar flowers are almost hidden in the soil, whilst stretched out in the shape of a star the open fiery red blossoms of *Elettaria coccinea* may be observed. In some of the varieties of *Zingiber* the flowers are spiculated or stalked. All these flowers are shiny and often half rotten, similarly to the epiphytic *Bromeliaceæ* of Brazil.

It is not possible to treat of the lower vegetation, grasses, etc., but, as a rule, the soil between the shrubs and clumps of superior vegetation is covered with a carpet of herbs chiefly of the following kinds, *Urticeæ*, *Cyrtandra nemorosa*, and ferns, whilst *Begonia robusta* is also common ; springing from this level green covering taller shrubs are noticeable, such as *Pollia thyrsiflora* with its cobalt blue fruit and its white blossoms ; *Dianella montana* with similar colouring of fruit and flower ; *Disporum multiflorum* with its hanging bells of violet ; *Polygala venenosa*, etc.

If the leaves of this miniature forest are drawn to one side, the brown, damp and half rotten humus is visible. The space between the shrubs and herbs is great, although from above the soil appears to be well covered ; yet small plants, moss, etc., does not grow, neither are ground orchids remarked ; and yet one is surprised to observe under the leafy canopy the large white blooms of *Cyrtandra nemorosa* which spring from the base of the stalks of this plant. Where the stems of the *Saurauja cauliflora* are visible, the large white and red blossom which springs from its base is often hidden by the dense leaves of *Elatostema* and *Cyrtandra* and, under this shelter the insect life supported by these blossoms may be seen.

It is evident from the observations made that the forests of the moister zone, although they do not possess so high a temperature as those of the plains, yet, in their systematic composition, show a thoroughly subtropical character, whilst various characteristics such as buttressed stems, large climbers, woody epiphytes, etc., peculiar to regions possessing a large rainfall, give to them many of the traits of moist tropical regions.

(To be continued.)

Protected Forests.

It was very gratifying to find an answer to the article on Protected Forests in the August number of the *Indian Forester* from so able an authority on the subject as Mr. Baden-Powell: anything from his pen is always important. He admits that the article in the main justly supports the point contended for, which being the case, nothing more need be said, affecting the particular issue, as no question of rights are at stake : none were ever awarded on these ever-changing areas and never will be, it is imagined, although a Forest Settlement Officer once *did* endeavour to grant certain rights ; but his decisions were without the slightest difficulty upset on appeal. Concessions innumerable, however, have been given, which cause, it is thought, almost as much trouble as rights ; and in this connection Mr. Baden-Powell's remarks at page 146 of Volume XVIII of the *Indian Forester* are worth a persual.

The award of concessions wholesale in localities where a Working Plan has to be enforced, only brings the Forest Department into disrepute with the people, and the Revenue and Forest Officers into conflict.

But, wherever the locality be, forests when placed under systematic treatment and especially where numerous concessions have been awarded, are bound to be the cause of a certain amount of discontent and dissatisfaction which must be put up with.

Circumstances now can scarcely be as they were 50 or 60 years ago when the country possessed no railways and no large industries. Cultivation was then very limited and the population sparse : cattle were allowed to graze at will, and the people to remove what was wanted from the jungles without restriction.

As they had been accustomed to this hand to mouth policy for so long remonstrance naturally came when the old habits were suddenly arrested ; but habit is overcome by habit as a great worthy has said and the habit of economy and self denial must be inculcated into them, if it be required to retain forests permanently and if the existence of future generations is not to be jeopardized.

It is only where forests are administered in a haphazard and lax manner that perfect tranquility prevails ; instead, therefore, of being satisfied with the condition of things in such localities, it behoves the Government to look into them and ascertain how things are progressing. The idea which exists in England, and in the minds of many, that the annual yield only, and not the forest capital in India is being exploited everywhere, is, it is thought, rather incorrect. Several places may be named where all is confusion and where valuable forest property is fast disappearing for want of a Working Plan. A great stride toward betterment has been made during recent years, it is true ; but the progress is slow, and without a larger establishment and more expenditure, some of the valuable state property will be found to have disappeared by the time a working scheme has been introduced. It is not intended to bring a charge of neglect against any individual or body of individuals with regard to the manner in which many District are administered ; the real facts are that Districts are too extensive and the executive duties af a Divisional Forest Officer are so heavy that time does not permit, nor does the establishment at command enable, a Working Plan to be even started. But to return to the question of the forests on the alluvial lands which were alluded to in the April (1893) No. of the *Indian Forester* ; and whose character was assumed to be temporary another aspect of the question has revealed itself with regard to them when judged in conjunction with proprietary right in the soil which rather disturbs the original theory and justifies their claim from a forest point of view to be considered permanent. The forests on these lands, it will be remembered, are all reserved under Act VII of 1878 ; and as property right in the soil exists down to the centre of the earth would any washing away of land, *i. e.*, change in the river's course, interfere with the right of the Forest Department to the land alleged to be removed? As explained in the article, a forest has been known to exist on one side of the river and Government waste or Zemindari property to be on the opposite bank. The river suddenly changes its course, and flows *over* the forest property, cutting off as it were a slice and leaving an addition to the property opposite. According to the rules in force, the Forest Department loses the land cut off; but is this legal? The land below water and the portion above on the opposite side, up to the extent of the area gazetted, is apparently *still* forest property, the water merely being an accidental or temporary surface covering for a few seasons.

In like manner, can an addition to the forest area result by the action of the river? Any addition to a properly constituted Reserved forest cannot be made, legally speaking, except by notification in the Gazette, nor can any exclusion be permitted except with the sanction of the Government of India. Year after year, however, administration reports are reviewed by Government with these changes shown, yet no notice has been taken of them. It sometimes happens that a forest gazetted as Reserved disappears entirely, as was the case with one of over 1,000 acres which was constituted in 1878. A map of the forest may be found in the Divisional forest office and its position on the river bank is defined on all the old maps of the Taluka. Year after year the river crept further in, until at length the whole area disappeared.

Shortly afterwards it began to retire towards the opposite bank again, leaving alluvial land where forest property originally existed; but there being no mark nor indication of any sort to identify the former existence of any forest, the new deposit was claimed as an accretion to the village lands adjacent and accordingly the forest became permanently effaced. The re-formed land may be said to be merely a deposit on the surface of what was once reserved forest; but according to existing Rules the forest is gone for ever. If, as already stated, proprietary right in the soil exists down to the centre of the earth, cannot the Forest Department claim the new deposit by taking measurements and laying down the boundaries as originally demarcated even though there be no sign of any former boundary marks? The question as now briefly explained, was advocated recently by a very capable member of the Civil Service and one who possesses considerable knowledge of Forest Settlements; and it has such an important bearing on the constitution of Forests in localities similar to the one under reference that it would be interesting to have an expression of opinion from Mr. Baden-Powell on the subject, if he will condescend to offer one.

G. E. M.

II.—CORRESPONDENCE.

Tour in Jaunsar.

SIR,

I have read with interest Mr. Fernandez's criticisms on the Forest School tour notes for July and August 1893, and beg to forward a few remarks on the matters referred to by him.

Your correspondent enlarges upon the "generally unsatisfactory results of the Jaunsar Deodar plantations" but in this respect, I think any one who has examined, in detail, these plantations; compared them with other deodar plantations elsewhere; and also considered their cost, will agree with me that Mr. Fernandez is labouring under a mistake. I admit that his disparaging remarks apply to such places as the bare slopes of Bodyar and Korwah, where the natural conditions are most unfavourable for the growth of deodar, but I think every one will admit that some of the older plantations such as Konain, Koti Kanasar, Deota and Lorli are as successful as could be expected.

The comparative cost also of these plantations should be considered, as they have in no case exceeded Rs. 30 to Rs. 40 per acre, whereas, I understand, the successful plantations Mr Fernandez refers to elsewhere, have cost at least Rs. 100 per acre, which makes a considerable difference.

I quite admit the truth of Mr. Fernandez' remarks about the great advantage of using good strong nursery plants, especially when the conditions are not very favourable, always provided they can be handled properly by skilled workmen. It, however, often happens that at the critical time when the planting has to be done, one is obliged to employ ordinary untrained coolies, who invariably cut or damage the big roots and the result is eventually much less satisfactory than if smaller plants had been used.

Under the circumstances, therefore, it has been customary in Jaunsar to use plants varying from 12 inches to 18 inches high, which dimensions are usually attained by plants growing in favourable nurseries is about 2½ years.

The following is a statement of the progress and treatment of the young plants in the nurseries previous to planting out in the Forests.

The seed is sown in November and germinates in the following March and the young seedlings are pricked out in the nursery beds during July, 6in. × 7in apart.

These seedlings are again pricked out during the following July, 9in. × 6in. at which time they are 16 months old.

During the following July or when the seedlings are 28 months old, most of the plants, if grown in favourable nurseries, will have attained from 12in. to 18in. in height, and are then considered fit for planting out in the Forests.

All plants which are not vigorous enough for planting out are again transplanted and left for another year in the nurseries.

As regards the planting out of basketted plants, I explained the method in a recent article in the September number of the *Forester*, and from that letter it may be seen that the average age of basket plants when put out in the jungle is two years.

Under the circumstances, therefore, the writer of the School tour notes was not far wrong in his statement that plants "about (*not "only"*) two years old, were ready to be put out in the Forest." Of course, I am willing to admit that good 3 to 4 year old plants, if planted out carefully, will give better results than 2½ year old seedlings, but taking into consideration the chances of damaging the roots of big plants, and the extra cost, I think that after all, the smaller plants, if vigorous, are probably the best to use on a large scale.

Regarding your correspondent's observations about the failure of blue pine plantings, perhaps it will interest him to know that we have tried large kail plants also with unsatisfactory results. The fact is that blue pine has got very tender rootlets and is not suitable for rough treatment by unskilled workmen; and probably, after all, sowing "in situ" is the best method for the propagation of this species.

Regarding your correspondent's concluding remarks about the probability of blue pine seeds having been carried to Lorli from Matkangra, through the agency of birds, I have carefully considered the matter, and think there is a good deal to be said on both sides of the question.

In the first place it should be noted that the heights of Matkangra, from which the seeds are supposed to have come, are not more than 1½ miles distant and possibly there were several trees nearer at the time the Cantonment was started. Again, it does not seem to me to be very conclusive evidence that because the jungle crows referred to shewed a decided partiality for gnawed chicken bones, that they would take the trouble to carry kail seeds in their beaks all the way to Lorli. In my opinion, it is more likely that the seeds might have been deposited by Himalayan nutcrackers or chir pheasants who feed greedily on blue pine seeds. and might, therefore, bring them from a great distance. It is nevertheless a well known fact that winged seeds are often carried long distances by the wind, but after what has been said above, I am rather inclined to attribute the appearance of blue pine seedlings in the Lorli Block to Mr. Fernandez's bird theory.

E. Mc A. M.

NOTE.—We confess to believing ourselves, that the wind theory is the most likely one. And, as regards transplants, it is not a question of *age* at all, but of *size*: if we can get big enough plants at two years of age, we certainly ought not to wait till they are 5 *years* old before planting out in order to carry out a theory.

HON. ED.

Recruits for the Forest Department.

A correspondent, writing with reference to the article on this subject in our January Number, says as follows :—

In *Truth* of 21st December, I find the following remarks on the last reports of the visitors of Woolwich Academy and Sandhurst College.

" The conclusion to be drawn from these reports is that the ' teaching of both the Military Schools is defective in almost all ' essentials, and that our Officers are to a corresponding degree ill- ' educated and inefficient. So it must continue to be while the ' entrance to these Schools is regulated, not with a view to obtain- ' ing lads well grounded in the subjects on which Military Educa- ' tion rests, but with the view of maintaining the aristocratic tradi- ' tions of the Service, and suiting the convenience or the whims of ' one class of Schoolmasters."

It is precisely by suiting the convenience and whims of one class of Schoolmasters instead of obtaining lads well grounded in the subjects on which a Forester's education rests, that the authorities are making mistakes in the recruitment of our service.

A new Himalayan Beverage.

DEAR SIR,

The other day I noticed some Kanawaries drinking what I thought was tea, but which turned out to be a liquor made from a hard gum-like substance found in hollow and decayed stems of the birch, walnut and oaks ; that obtained from *Quercus Ilex* is called " Brechi" and that from *Betula Bhojputra* " Chhatub"; the latter is said to be preferred, while the former, besides being used as tea, is sometimes employed in making writing ink. A pinch or two of either " *Brechi*" or " *Chhatub*" put into a cup of boiling water produces a liquor very much like strong tea in colour, but of no particular flavour.

I am sending specimens, which I request you will kindly have examined, as perhaps these gum-like exudations may be of some importance as an economic product. It is well known that in Kanawar and Thibet, an infusion made from Yew bark is drunk by the people, and it is believed that both this bark and a substance similar to " *Brechi*" and " *Chhatub*" enter into the composition of the Thibetan brick tea.

G. G. MINNIKEN.

III.-OFFICIAL PAPERS & INTELLIGENCE.

Usar Reserves at Cawnpore and Aligarh.

The following report was recently drawn up by Mr. J. F. Duthie, Director, Botanical Department, Northern India, as the result of a visit to the Usar reserves at Cawnpore and Aligarh. Mr. Duthie's conclusion that the importance of protection has not been sufficiently appreciated, is only a confirmation of the views which find expression in the Government of India Resolution No. 16A, March 1st, 1883, on the injury done by cattle and goats to the grass lands of the country. In this Resolution it is stated that "In the North-Western Provinces various experiments have been, for three years, conducted by the Agricultural Department, with the view of reclaiming *usar* or *reh* lands. It has been found that the simple expedient of enclosure is more efficacious than any other operation. The natural grasses which, so long as the land is accessible to cattle and goats, are nibbled down as fast as the young shoots appear, spread in the enclosed areas at a rapid rate over the worst land. After two years, experimental cuttings gave a result of 20 maunds of good hay per acre—an outturn which, on a square mile, would suffice to feed 1,000 cattle for three months, exclusive of the bushes and trees which, there is good reason to believe, can be grown when once the grass is well established.

Juhi (*Cawnpore.*)—A careful examination of the grass vegetation in the experimental plots, gave evidence of still further improvement as compared with results previously recorded. There are now very few bare-looking patches, and none can be found which are absolutely so. In fact, a large portion of this reserve may now be considered as practically reclaimed. Mr. Miller, Director of Agriculture, who is also of this opinion, intends, I understand, to have a portion of it broken up at once for cultivation.

In November 1891 I selected two of the plots (Nos. 39 and 49) for experimental sowings of certain kinds of indigenous grasses. The ground was prepared and the seed sown according to instructions given, but, as the water-supply failed, the results were also a failure.

Chherat (*Aligarh*).—As the cattle employed in connection with the Dairy Farm here have been allowed to graze over the greater portion of this reserve, the grass growth now appears very scanty compared to what it used to be. The question of grass grazing in India requires, I think, more care and attention than it has hitherto received. In this country the indigenous grasses of pasture lands have a much greater struggle for existence than those of more temperate climates, as in Europe for instance. In the plains of Northern India the grass vegetation is exposed to alternate periods of extremes in temperature, and often to excessive moisture. The people of this country take no care about the preservation of pasture land. Their one idea seems to be to let their cattle eat up or tread down every green blade as soon as it makes its appearance, until at last nothing remains for them to eat. The tread of cattle is injurious at all times, but more especially when the young shoots are beginning to unfold. Reproduction is then literally nipped in the bud.

On the low-lying parts of the Chherat reserve, where the ground is under water for a considerable time during and after the rains, I found that the *bat* grass (*Diplachne fusca*), which thrives in such situations, had spread very much since my last visit. It is a good fodder grass, and should be encouraged.

The plantation of seedling Date Palms is doing fairly well but they still require attention, and should be watered occasionally during the hot season.

Gursikran (Aligarh).—The condition of the ground occupied by the experimental plots continues to show improvement as regards the extension of grass growth. Many spots, which five years ago, were absolutely bare and efflorescent, are now completely covered with grass.

The area containing the experimental plots was purposely selected in 1888 on account of there being included in it a large number of bare and efflorescent spots; there were also several patches of dub grass and other kinds, besides the characteristic usar grass; and extending through some of the plots there were several lines of depression acting as drainage channels, on the slopes of which dub grass was plentiful. The varied nature of the vegetation has, according to my observations, acted very materially towards bringing about the generally improved condition, year by year, of this portion of the reserve. The greater part, however, of the Gursikran reserve is entirely covered with the ordinary usar grass (*Sporobolus pallidus*) which grows excellently well, and produces heavy crops every rainy season. The uniform character of the soil over a large area, and the absence of competitive influence on the part of other kinds of grasses, tend to encourage the luxuriant growth of the usar grass, and those portions of the reserve which are thus exclusively occupied by this grass appear to me to be incapable of further improvement by means of protection alone.

As a fodder-yielding species this grass has not been fairly tested. It is said to be too coarse for making into hay, and certainly it is so when cut after the rains are over, which is the usual custom in this country. As it is known to be a good grazing grass, we may presume that it is fairly nutritious. If, therefore, owing to damp weather during the rainy season, it cannot be made into hay at the time when it should be cut, it might be preserved in silos, as I suggested some years ago in the Introduction to my book on the Fodder Grasses of Northern India.

The ultimate aim, however, in all attempts to reclaim what is now uncultivable usar land is to render it fit for cultivation. The successful results which have recently been obtained at Cawnpore and Aligarh are encouraging; the ground at Amramau is now under cultivation; the greater portion of the Juhi reserve may be considered as practically reclaimed; and considerable progress is being made at Chherat. The area thus affected constitutes, however, a very small fraction of the three million acres waiting to be reclaimed in these Provinces.

There can be no doubt that, as a preliminary measure, the protection of waste usar land from cattle does wonders, and at the Juhi reserve it may be considered to have done all that was required. But in the case of extensive areas, the soil of which is uniformly bad, or where the vegetation is exclusively composed of the ordinary usar grass, some further remedy is needed to supplement the good effects of protection.

If expense were no consideration, the reclamation of reh-infected tracts might be brought about speedily in a variety o' ways. A thorough system of sub-soil drainage would probably have the desired effect. This idea was suggested many years ago, but I am not aware if any steps were taken to have it tried on a sufficiently large scale.

Another proposal was to cover the land with silt. This has been carried out with considerable success in certain localities within reach of canals, and with aid of water as a vehicle.

A more recent suggestion made by Mr. Gladstone, Deputy Commissioner of Umballa, is to plough into the reh soil a top dressing of river sand. Mr. Gladstone maintains that the sand will act beneficially on the soil as a dilutant; and so, by diminishing the relative strength of the noxious salts, a soil will be produced which will support vegetation, and lead ultimately to its cultivation. The cost of transporting the sand would, of course, be a heavy item but Mr. Gladstone is of opinion that results would more than cover expenses. An experiment on a small scale is now being tried at the Chherat reserve.

The demand for cultivable land will in time no doubt necessitate the adoption of more extensive measures for the reclamation of usar land, the costliness of which is at present the only real drawback. In the meantime, however, I would recommend the continuation of experiments with various plants such as are likely to thrive in reh soils. As a promising example, I would mention the *frásh* (*Tamarix articulata*), a common tree in the Punjab, where it thrives well on saline soils. It is easily progagated either from seed or by cuttings, and is a quick growing tree.

Sir D. Brandis, in the Forest Flora of North-West and Central India, page 22, says that the slender twigs are frequently hoary with saline efflorescence. He also mentions that the wood is strong and durable, and is used for making ploughs, Persian wheels, and other articles ; and that when well seasoned it makes good fuel. The bark is used for tanning, and the galls produced on the branchlets are employed as a mordant in dyeing, and also in tanning. The seed of this tree is obtainable during the rainy season. Two other species of Tamarix, *viz.*, *T. gallica* (known by the name of jhau) and *T. dioica*, might also be tried. These latter are shrubs, and are found abundantly on moist alluvial lands, or on river banks ; they also appear to thrive in soils impregnated with salts. The lower and damper portions of the reserves at Gursikran and Chherat would probably suit them well. The seed ripens during the cold season.—*(Agricultural Ledger Series.)*

The Campbell-Walker Prize for Forestry at the Dehra Dun Forest School.

We have received, from the Inspector-General of Forests, for publication, the following letters, which will fully explain themselves.

SIR,

In reply to your letter No. 782 dated 8th August 1893, I have to inform you that the suggestion made by the Director of the Forest School, *viz.* "that the interest on the Rupees 540-9-0, 'amounting to about Rupees 20 yearly, should be spent in a prize 'of books to be awarded to the best Madras Student in Forestry in 'the Forest Examinations, under the orders of the Board of 'Control," commends itself to me and the majority of my fellow subscribers as suitable for adoption.

I enclose a letter from Colonel I. Campbell-Walker, which I beg you will kindly send to the Editor of the *Indian Forester* with a request that, with his kind permission, it and this letter may be published for general information in that journal.

Yours truly
S. C. MOSS.

ARMY AND NAVY CLUB,
PALL MALL, S. W.

24th September, 1894.

DEAR MR. MOSS,

I am in receipt of yours of 9th ultimo. with it enclosures informing me of the foundation of an Annual Prize (Silver Medal) for Forestry in my name at the Forest School, Dehra. I highly appreciate the honor done me and I shall feel much obliged by your conveying my thanks to the other contributors. I was already well repaid for anything I had done to promote the interests of the Department and its Staff by the good work and support of yourself and others who are a credit to any service.

But I shall never forget this kindly mark of your esteem and regard, through which the memory of my humble efforts will be perpetuated at the Forest School.

I need scarcely add that my interest in the Department and its Officers of all classes, remains unbroken and if I can ever be of service to it or them in any way, you may command me.

With all best wishes for you all,
Believe me,
Yours very faithfully,
J. CAMPBELL-WALKER.

Revised Rules for the entry of Native Non-Commissioned Officers into the Forest Department.

I.—Any such officer, who is recommended for the purpose by his Commanding Officer, may apply to a * Conservator of Forests in the Bengal Presidency, or to the Director of the Imperial Forest School at Dehra Dun, for permission to follow, at that institution, the course of instruction in the Upper or English class, with a view to secure, after successfully passing through the School and obtaining a Ranger's certificate, an appointment as Forest Ranger in one of the Provincial Forest Services.

Addresses of Conservators of Forests in the Bengal Presidency.

- Bengal Circle, Darjeeling.
- Assam Circle, Shillong.
- N.-W. P and Oudh—
  - School Circle, Dehra Dun.
  - Central Circle, Naini Tal.
  - Oudh Circle, Naini Tal.
- Central Province—
  - Southern Circle, Nagpur.
  - Northern Circle, Jabalpur.
- Berar Circle, Amraoti.
- Punjab Circle, Lahore.
- Upper Burma—
  - Western Circle, Mandalay.
- Lower Burma—
  - Pegu Circle, Rangoon.
  - Tenasserim Circle, Moulmein.

II.—The Forest Officer to whom application is made must be satisfied—.

(*a*) that the candidate will not be more than 30 years of age when he enters the School.

(*b*). that he has been sufficiently well educated, especially in Mathematics and English, to enable him to follow the School course with advantage and to obtain a Ranger's certificate;

(*c*) that he is of good constitution and active habits, and possesses fair ability and powers of observation, as well as such physical qualifications as are required for a good Forest Officer.

III.—If the conditions in the preceding rule are satisfied and the candidate is accepted by a Local Government for an appointment in the Provincial Forest Service, he may be admitted to the School, and be allowed to receive the stipend admissible to private students under rule 12 (ix) of the rules appended to Circular No. 11-F., dated 28th June 1894. While at the School, with the exception that he need not attend drills, he will in all respects be subject to the rules appended to that Circular.

IV.—On obtaining a certificate at the conclusion of the School curriculum, the candidate will be eligible to be appointed as Ranger. On being so appointed, he will be subject, as regards future promotion, to the regulations of the Forest Service for the time being. As regards other conditions of service, the candidate either shall, on obtaining his appointment to the Forest Department, take his discharge from the Army, and then 12 months of his period of instruction at the Forest School will count as service under article 388, rule 4, of the Civil Service Regulations; or he may serve in the Forest Department and be transferred to the Native Unattached List under the conditions in Army Regulations India, Volume II, Part II, and in that case he will qualify for the special rates of pension admissible under military regulations, (See Army Regulations, India, Volume I, Part II.)

V.—During the School course the candidate will be seconded in his corps, which he shall rejoin if he fails in obtaining a certificate.

These rules have been framed to replace those of Circular 25F of November 13th, 1880, which were found impossible to work in connection with the recent new Rules for the Forest School. They do not apply to the Presidencies of Madras and Bombay; but the Governor General in Council recommends them to the consideration of the Governments of those Presidencies.

Remission of Forest Revenue to Treasury through the Post Office.

The Government of India have called for report whether this arrangement might not be adopted with advantage in most Provinces. It arose in Bengal, where the Conservator, finding Treasuries few and far between, suggested the use of the Money Order system and remittances through the Post Office ; and after some discussion he was allowed to introduce the new system which was found to be an improvement.

IV.-REVIEWS.

Forest Inspection Reports on the Districts of Salem, North Coimbatore, Anantapur, Bellary and Vizagapatam.

Mr. Popert's report on Salem, though short, is interesting, chiefly on account of the evidence it brings of the importance of substituting systematic working of even a temporary and rough character for systems of sale by permit, etc., which only tend to deterioration of the stock. This is what the Conservator says of the District Forest Officer, Mr. Brasier, in this connection.

" I was pleased with the strides made by your present District ' Forest Officer in this direction. He has opened coupes practically ' throughout the district, and the permit system is becoming a ' thing of the past. He deserves particular credit for the judicious ' manner in which he has effected the change ; during my tour I ' heard only one complaint which proved to be entirely unfounded, ' and which owed its origin to a contractor of adjoining zemin ' forests who, under the old system of indiscriminate felling ' throughout the forest, was most probably able to smuggle a considerable quantity of forest produce from Government Forests ' under cover of zemin permits."

The badness of the staff and its venality are the chief matters upon which the Conservator has remarked. It may be hoped that the effects of forest education may soon shew themselves, but Salem is, we should think, a difficult District in which to stop bad practices, which have probably gone on for several years.

The note on NORTH COIMBATORE, has some points of interest. First of all we reproduce Mr. Cherry's suggestion for the management of the Vellamundi Revenue on the Bhavani River which is a poorly stocked piece of forest, a good deal overrun with prickly pear. These suggestions are :—

"The reserve should be closed to permit-cutting.

'The avaram shrub should not be worked for three years.

'Cattle grazing should be limited to one head for every 5 'acres.

'The reserve should be divided into blocks of about 1,000 acres 'and each year a block (beginning with the most easterly which 'should be taken up this year) should be operated on as follows :—

'(1) The prickly-pear must extracted and either burnt, or 'used to temporarily fence the block.

'(2) All blanks must be run over with a plough and seeds 'of tamarind, turinji, *Albizzia lebbek*, neem, satinwood, *Pithecolo-'bium Saman*, avaram and any other suitable seeds must be freely 'planted in the plough furrows just before the rains.

'(3) The existing growth should be retained as shelter until 'the seedlings are sufficiently established, when

'(4) The existing growth should be coppiced under standards 'departmentally and removed with as little injury as possible to 'the seedlings.

'(5) The blocks that are thus being treated should be entirely 'closed to grazing and must be fire protected.

'If the District Forest Officer can manage a block on the 'west at the same time, so much the better, but as the growth on 'the west is very much better and there are few or no blanks, it 'may be possible to begin coppicing there at once and so provide 'any village fuel that may be necessary to make up the deficiency 'caused by stoppage of permits.

'The object is, to get the whole area re-stocked with seedlings 'and then the present pollarded growth coppiced so as to get a 'more uniform growth in as few years as possible."

We do not quite understand (4) : is it meant that the whole forest is to be coppiced (it contains about 19,000 acres) in 19 years? We suppose so, and if so we hope to find in future reports, accounts of the result. It seems doubtful whether it will *pay* but there can be no doubt as to its sylvicultural advantage.

The Conservator recommends a hedge of the valuable Coimbatore hedge plant, *Balsamodendron Berryi* being planted by means of cuttings.

He very properly animadverts on the practice he discovered of keeping dynamite and fuses loose about the Divisional Office. Like Mr. Popert, Mr. Cherry is also anxious to introduce a 'coupe' system of felling instead of sales by permit and we are glad to see that in this he is supported by the Collector and the Board of Revenue. North Coimbatore is lucky in being off the beaten track and the Conservator can there carry out what would not be permitted by the amateur foresters in the adjoining District of Nilgiris.

The note on ANANTAPUR by Mr. E. D. M. Hooper, dated December 16th, 1892, is long and detailed, but there is little which is of sufficient general interest for our readers. The Anantapur District is a very interesting one in many ways to a Forester and the absence of more than a very scanty record of the improvement of growth of the forests seems a pity. Some of the Reserves were almost bare when taken up first and inspection notes ought to record the improvement in growth which is naturally more easily noticed by a Conservator, who inspects at intervals, than by a Divisional Officer who sees the forests frequently. The following, on *Hardwickia*, probably will, however, be of interest. "*Hardwickia* has made great strides since it has come under 'protection. The custom of pollarding the trees for the fibre of the 'shoots has been entirely stopped and the supply of seed has con'sequently been enormously increased. Judging from what I 'have seen, I imagine that germination of the seed follows very 'soon after its fall with the early rains, but that the young plants 'dug down to their roots for one, if not for several years, each 'season putting on a stronger growth, which eventually persists 'in asserting itself."

Mr. Hooper's note on BELLARY of January 1890, also contains very little of general interest, it is full of detail of more or less unimportant matters and the most noticeable thing is the recommendation bestowed by the Collector and Conservator on the native District Forest Officer, Mr. Nallasawmi Naidoo. It is disappointing to find no account of the progress of work in the Sandur leased forests.

In Mr. Hooper's note of January 6th, 1893, on VIZAGAPATAM there is also comparatively little of interest. It must have taken long to write, for it takes 26 pages of the Board's Proceedings, but the only extract we can find of any importance is the following, which Forest Officers in charge of Sal Forests in North India will be interested to read.

"*Natural Reproduction.*—The species we are most concerned 'with the reproduction of in the Vizagapatam district differs in the 'various ranges. In Palkonda it is the sal (*Shorea robusta*), ac'companied, however, by other accessory species, some being so 'generally distributed as to be of distinct advantage or it may be 'harmful in their action, and, as an instance of the latter, I would 'mention that in parts of Palkonda the growth of *Lebedieropsis* is 'remarkable and apparently detrimental to the spread of sal, to the 'growth of which—always an interesting study—Mr. McArthy has 'already devoted some attention. It here appears as a sapling 'pole rising generally to 30 feet with a diameter of 5 inches, though 'occasionally found 40 feet high and 1 foot in diameter. The 'original stools are still living in most cases and there is little or 'no evidence in old stumps or pollarded trunks of the former 'growth having assumed large dimensions. The sharply defined 'limit of the local distribution of the sal is here quite as evident as 'in Upper India where it often forms an almost pure regular forest 'growth and apparently takes possession of abandoned cultivation 'on the exact area of which it proceeds to rear an even growth 'of coppice Left to itself, the sal as a species tends to monopolise 'the soil, and gradually the herbaceous growth below it becomes 'reduced to a mere carpet of a few straggling annuals in which, 'even grass grows with difficulty. As a consequence, the only fuel 'to feed the forest fires is the carpet of fallen dry leaves and such 'ringed and completely dead trees as are lying or still standing. 'There is very little to entice animals to graze in ordinary sal forest, 'and once the poles have asserted themselves and form canopy, the 'presence of animals does but little harm. In the extreme youth 'of the species it will be found, however, that cattle must be ex'cluded and danger from fires most carefully guarded against."

British Forest Trees.

We have received from the Author a copy of "British Forest Trees" by Mr. J. Nisbet, D. Œc., Deputy Conservator of Forests in Burma, an interesting treatise in which the leading principles of sylviculture, as applied to the principal species of British forest trees, are ably set forth in a concise and readable manner. As the Author himself informs us in the preface, the work is not one of original research, but is to a considerable extent compiled from the best German Authors, to the information obtained from which, has been added the results of the Author's own personal observations and experience.

After a short introductory historical sketch of the forests and woodlands of Britain, the requirements of forest growth are then considered. The main portion of the book is then devoted to a description of each of the principal species of trees which form or are capable of forming pure forests. Each species of tree is systematically and separately described, its distribution characteristics and requirements as regards soil, situation, light, &c. being given, and also its peculiar liabilities to damage from external influences and disease. Its sylvicultural treatment is then discussed at some length, distinction being made between the cases where it forms pure forest and where it is grown as the ruling species in mixed forest. The reproduction of the species both by natural and artificial means is also briefly considered.

---

* British Forest Trees by J. Nisbet, D. Œc. London. Macmillan & Co., 1893. 6s.

The latter portion of the book is devoted to the minor species of trees both indigenous to Europe and introduced, which do not usually form pure forests in Britain. Many of these are necessarily disposed of very briefly but a full description of the more important of them is given on the lines indicated above.

On the whole, the work is a well written one and must have entailed on the Author a considerable expenditure of time and labour. It might, perhaps, have been a little more conveniently arranged in chapters, but this, if a defect, is a minor one and we trust that "British Forest Trees" will receive the approval it deserves from all foresters and others interested in the growth and management of forests and woodlands in Britain.

Of course, as was to be expected of Messrs Macmillan and Co., the general get up, print and binding of the book are excellent and the price moderate.

VI.—EXTRACTS, NOTES AND QUERIES.

Afforestation in England.

A represontive of the *Chronicle* recently had an interview with Professor Schlich, lately the head of the Indian Forestry Department, and now attached to the Royal Indian Engineering College at Coopers hill. Both Professor Schlich and his colleague, Mr. W. R. Fisher, are experts in the whole science of Forestry, and Dr. Schlich is the author of the valuable "Manual of Forestry" from which the *Chronicle* quoted the other day in suggesting a scheme of afforestation which would serve the purposes of adding to the national wealth. reclaiming waste land, preserving and adding to our national store of timber, saving a huge import from wood-growing countries, and at the same time securing work for the workless. Professor Schlich has been the subject of an interesting experience which throws a vivid light on the problems of Irish Government opened up by "X" in the *Fortnightly Review.* In the latter part of 1885, Dr. Schlich, in the course of a tour in Ireland, made some investigations into the possibilities of a scheme of afforestation for that country. The late Lord Carnarvon heard of them, was greatly interested, and suggested an interview. About that time, however, occurred the break-up of the Conservative Government, and the only result of Lord Carnarvon's overtures was the writing of a pamphlet, in which Dr. Schlich proposed the re-afforestation of waste lands as an adjunct to a general scheme of State purchase. Lord Carnarvon's successor took no notice of the suggestion, and Ireland was again left to sink more deeply into the morass of hopeless poverty.

As it happens, however, the problem in England is very nearly as pressing as that in Ireland. Dr. Schlich calculates that there are 26,000,000 acres of waste land in the United Kingdom, of which nearly 6,000,000 are situated in England. One-half of this could be profitably laid down in forest land, but the planting of 6,000,000 acres would suffice to replace our annual import of timber. The case is all the more urgent because, as Dr. Schlich pointed out to our representive, there is every probability that this supply will be greatly curtailed. Canada, for instance, is wearing out her forests and killing the goose that lays the golden eggs. However, nearly every country but our own is waking up to the necessity of economising its heritage of trees.

"Is it not true," asked our representive, "that we are practically the only country that does nothing for the preservation and extension of our national store of forests?

"Well," said Dr. Schlich, "other nations are certainly waking up on the subject. The State is stirring in Belgium, which was very backward; and even in Russia, where forestry is still in the rough, progress has been made. In the United States there is a strong movement in favour of afforestation owing to the serious extent to which the timber is giving out."

"And what have we done?"

"Well," said Dr. Schlich, "we planted 14,000 acres of oak in the Forest of Dean from 1816 to 1825. But the thinnings have been too heavy, and the result has been that the trees have not attained a proper height-growth. Then we planted 9,000 acres outside Windsor Park about the same time. But Windsor has always been treated, not as a national forest, but as a royal shooting ground. Then there was a further plantation of 18,000 acres in the New Forest. But on the whole it is a fact that the old English forests are failing. It is useless for Mr. Auberon Herbert to speak of their æsthetic beauty and of the necessity of preserving them as they are, in order that ladies and gentlemen may paint them. Things have gone rather too far in England for that. My idea is that scenic beauty and usefulness might very well be combined in English woods. As things go, the forests are getting poorer and poorer, swampier and swampier, every year. In one particular, the soil becomes seriously deteriorated by the formation of what we foresters call 'pans.' In other words, the rain washes down particles of clay, which, mixing with the oxide of iron in the soil, forms a firm cohesive mass that has to be removed by iron tools. Much the same considerations apply to the great private forests. They are not treated on any regular plan. Now, the owner, wanting money, will order a wholesale clearance of trees; now again he will suffer whole forests to remain untouched for years. What these gentlemen, no less than the nation, want, is a systematic plan for dealing with forests on a regular system of thinning and renewal. Unless forests are so managed that approximately the same quantities of material are brought into the market annually, it is hopeless to expect forest industries to spring up, and to realise good prices by the sale of the produce."

"As to the second point of my inquiry—is afforestation practical as a means of dealing with the problem of the unemployed? For instance, is it possible in winter?

"Certainly," said Dr. Schlich, "you can plant trees all through the winter, save only when it is freezing. The principal work is, of course, the digging of holes for the planting, and that is clearly unskilled labour. In my 800 acres near Ascot, which I use for the instruction of my school, the labourers get 3s. a day."

"As to the cost of a larger experiment in forestry," added Dr. Schlich, in answer to further questions, "I have calculated that a return may be obtained from all kinds of land, and it comes out, reckoning every possible outlay, and including compound interest on the money invested, at the rate of about 2¾ per cent. profit. As for the nature of the land which can be rendered profitable by afforestation, almost any kind is useful which can be obtained for £10 an acre, and that is always worth putting down in Scotch firs. To take one item alone, you might save the 70,000 tons of mining props which are every year exported from Bordeaux. There is no reason," added Dr. Schlich emphatically, "why every stick of these should not be grown at home. From the labourers' point of view, as I have said, the peculiar advantage of forestry work is that it can be done when no other work is available."

"You think then that an experiment in afforestation could very well be made?"

"Yes," said Dr. Schlich, "and though, of course, the exact return would depend upon the quality of the land, you could rely on some such result as I have indicated. The cost of planting would perhaps average about £6 an acre, £7 or £8 where there was a 'pan' and £4 or £5 where there was none. Supposing the nation laid out £60,000 for the purchase and planting of 7,000 acres, the work would provide labour, say, for forty days per acre at the slackest time of the year."

"As to organisation—what would you suggest?"

"I would say in general terms that it would be possible to associate an experiment of this kind with the office of the Commissioners of Woods and Forests, if not with the Agricultural Department. An area might be taken, say, a series of blocks, each extending to 2,000 acres, and an expert employed to draw up a plan of operations. The country has plenty of qualified practical foresters, and the planting might very well be done by them. The danger of failure would occur in the subsequent treatment of the woods. This could be provided against by instituting a course of schooling in forestry for land surveyors and agents. Perhaps this new school might be established in connection with the

Coopers hill College, which might very well institute a short course, hold technical examinations, and possibly confer diplomas. Or an efficient course might be established in connection with one of the agricultural colleges. Then, if the experiment succeeded, a specially qualified commissioner might be appointed to superintend the work of the growing department. That the culture of woods is profitable there can be no manner of doubt.—(*Daily Chronicle.*)

The Fall of the Leaf.

Mr. A. Ransom writes as follows in the *Bedfordshire Times*:—The above title will suggest to many minds a kind of moralising that is the opposite of exhilarating. Indeed, I hold that the common sentiment connected with the fall of the leaf is false both in fact and taste. The fall of the leaf is no more a symbol of death than are any of the wonderful and beautiful changes that take place in the order of nature. A leaf is not a living entity —it is but a temporary organ developed for a definite purpose and for a definite time, to be dropped off when it has done its work for the plant that produced it. In fact—as I shall presently show—its fall is, to the twig on which it hung, rather a sign of life than of death. And then how beautifully nature effects this disposal of its no-longer useful organs! We have this year had an exceptionally brilliant example of this. It would be necessary almost to exhaust the artist's colour-vocabulary in order to describe the tints that our trees and shrubs, our trailers and our climbers, have lately assumed. Some golden leaves still hang on the poplars and limes, rich brown ones on the oaks and beeches, and the creepers on our houses still give us crimson and scarlet pencillings of every possible tone. The effect is heightened by the admixture of the so-called evergreens, which afford all shades of green as a kind of background against which the brilliant hues of autumn stand out in the most beautiful contrast. In passing, it may be remarked that these evergeens are in reality "evergreen" only in language. Their leaves do not last as long as the trees that bear them, any more than do the leaves of the trees whose boughs are now beginning to show graceful outlines against the crisp autumn skies. An "evergreen" is a tree that keeps each summer's leaves for two or more seasons, and thus, though it every year loses as many leaves as it produces, it always has one or more seasons' leaves upon its boughs.

In our climate the fall of the leaf is so conspicuous a stage in the year's plant life, that a brief explanation of the process by which it is effected cannot fail to interest even the least scientific reader. The process is simple and can be easily explained; and when understood it will show the reader that it is quite a mistake to look upon the fall of the leaf as an emblem of death. The change of season that accompanies it and makes it necessary may have some unpleasantness connected with it in the minds of the infirm, the delicate, and of those who have allowed the errors of our modern civilisation to rob them of the healthy man's birthright of sympathy with nature in all her moods and phases. But this is quite another thing, and does not justify the sickly sentiment about autumn which I have mentioned above.

To understand the fall of the leaf, it is necessary to know, in the first place, that the leaf, when alive and performing its functions, is as intimately and organically connected with the twig as the arm of a man is with his body. The food, which it is the business of the leaf to manufacture, is conveyed from the leaf to the parts of the plant that need it, along channels that pass from all parts of the leaf into the inner structure of the plant. This can be proved roughly by trying to break off a vigorous leaf—the leaf does not easily separate from the twig at its point of juncture with it, any more than the arm of a man does from his body. But when the feeding season of the leaf draws to a close an organic change of beautful simplicity takes place. Just where the leaf stalk leaves the twig, there is formed a thin microscopic layer of cork, right through the leaf stalk, cutting asunder, not only the soft matter of the stalk, but also the tough fibres that run from the leaf into the wood of the twig. Now, this thin film of cork possesses two qualities which enable it to effect its purpose at the place where it forms. It is impervious to water, and it is very easily torn. The cork layer being impervious to water; there can no longer be any passage of sap from the leaf into the twig, or *vice versâ*. The leaf is no longer a part of the living system of the plant ; and as it has no independent power of vitality. there is set up in it at once a fresh series of chemical and physical, changes producing all those varieties of tint which make our trees so beautiful at this time of the year.

Bnt this is not all. So far the leaf is still hanging upon the tree, though it is no longer a vital part of the tree. Receiving no supply of water from the tree, and losing by constant evaporation the water which it contained when the layer of cork was first formed, it dries up and both the blade and the stalk—and especially the stalk—shrink. The twig, however, does not shrink—if anythings, it swells. Thus the end of the stalk, where the cork layer is formed, is strained. The stalk is no longer thick enough to cover the spot to which it is attached. Something evidently, must tear ; the cork layer tears asunder, and the leaf falls.

Nor is this quite all . Were a man's arm to be torn off at the shoulder joint, there would be caused an ugly wound. So, if a green leaf is torn off in summer there is caused a wound in the twig, very different from the slight mark which is left by the falling leaf. If the simultaneous fall of the leaves of a tree in the autumn left the tree covered with ugly wounds on all its twigs, the tree would suffer very materially, perhaps die. But the use of the thin cork layer above comes in here again. It not only makes a clean cut through the fibres of the leaf stalk, but covers the scar on the twig' with a waterproof covering that prevents the outflow of sap from within, and protects the spot against injurious influences from without.

A simple illustration of the fact that such a change as that above described does take place, may be easily found by anyone walking among trees in winter. A little observation will be sure to discover a twig, broken in summer, but still hanging loosely to the tree. Such a twig will still have its leaves on it. They are dry and dead and curled up, but they still hang tightly to the twig. This is because the twig died before the cork layer was formed between it and its leaves. Thus it keeps its dead leaves as part and parcel of itself : while the tree on which it hangs has naturally and normally shed its leaves.

Thus the fall of the leaf is only a process of life. In a climate like ours, leaves must do one of two things—they must either fall when the cold weather and short days come, or they must cover themselves with a surface that will resist the cold and help the leaf to sleep—or dose—through the months of diminished daylight. Our evergreens have adopted the latter expedient : their leaves are very leathery, and, in the cases of high trees exposed to wintry storms, they are narrow and thread-like, and thus permit the cold blasts to sweep harmlessly among them.—(*Timber Trades Journal*)

English Forestry.

Referring to the appointment of Mr. Stafford Howard to the vacant Commissionership of Woods and Forests, the London *Daily Chronicle* regrets that a practical forester was not selected. Our contemporary continues :—" Had such an appointment been made, a gigantic field of usefulness would have been opened out. As things stand, we are virtually the one country in Europe in which the State cares nothing whatever for its forests—that great treasure of the common people—and neither knows nor teaches even the elements of the science of afforestation. Our national wealth of timber is under no skilled guardianship whatsoever. No steps are taken either adequately to preserve or to increase it. In Germany, more than half the forest area is under the direct or the indirect control of the State, and the stock of timber is subject to constant supervision and renewal. Here nothing is done. We have a small and poorly endowed school for the training of candidates for the Indian Forest Service at the Engineering College at Coopers Hill, within a stone's throw of the magnificent but grossly neglected woods of Windsor. But our own woodland area is suffered to go to wreck. At the same ime we annually import some 6,000,000 loads of timber, and as many of the sources of supply are contracting, we may, within an ascertainable period, be face to face with a timber famine. In other words, we are—or were a few years ago—

spending some £13,000,000 sterling per annum on timber and timber products, while we have, according to the calculation of Mr. Schlich, the principal professor of Forestry at Coopers Hill, some 6,000,000 acres of waste land, which could, and should, be laid down as forests. Mr. Schlich estimates that we might annually plant some 300,000 acres employing at least 15,000 labourers which would sustain a population of 75,000 souls. After forests had been created, and (say in some forty years) we had entered on our new possessions, we should be, says Mr. Schlich, in a position to employ regularly some 100,000 workers, or a population of half a million people. It so happens that the opportunity for a national experiment in afforestation occurs at the very doors of the great Inferno of English poverty—the East End. There is plenty of waste land available between Barking and Pitsea, and Essex, especially that part of it which borders on London, is famous for its growth of English trees.—(*Timber Trades Journal.*)

Canadian Timber.

The *Montreal Daily Star* gives some figures to show the extraordinary advance in timber values, consequent upon the rapid felling of the pine forests. To an inexperienced eye there may be hardly an evidence at first glance of the disappearance of the pine. The hardwoods with which the pine is interspersed are usually left standing to a considerable extent, and so are the smaller pines, so that even a well-cut country will still look splendidly wooded. No doubt the time will come when it will be carefully re-cropped. But the commercial value is largely gone, and with it the natural desirability, for the cutting of the pine greatly lessens the value of the woods as vast reservoirs, holding the snows in spring and the rains of summer so as to feed steadily the innumerable streams of the water-sheds. Consequently spring floods and summer droughts for the cleared lands in the valleys follow close on the lumberman's axe. A certain amount of attention has been aroused by the rapid retirement of the pine. The Ontario Government has recently attempted to enforce strict precautions against fire, and it has also appropriated, as a provincial park, an enormous reserve near Lake Nipissing, thirteen hundred square miles, of which nine hundred are pine timber, situated on one of the chief natural watersheds of the province. But a great deal more than this is necessary if the Canadian pine forests are not soon to disappear like the tracts of Maine and New York. Enlightened men here are urging the establishment of regular systems of arboriculture, such as prevail in several of the chief countries of Europe, notably in France. It is hoped also that the Quebec Government will follow the lead of the Ontario Government in establishing a natural park on some of the main watersheds.—(*Timber Trades Journal.*)

An Arboretum in Austalia.

Professor Brown, of the Dookie Agricultural College, Victoria, who is well known in Scotland, and the northern parts more particularly, has successfully established an arboretum in connection with that Institution, of which he has for several years been the Principal The *Australasian* of August 19th contains a description of the arboretum and the progress which has already been made in the cultivation of trees and shrubs suitable for the climate of that colony. Two years ago, Professor Brown obtained the sanction of the Council of Agricultural Education to establish an arboretum to contain the principal native and foreign economic timber trees for the purpose of general reference, experimentation, and special education with his lectures. The first duty was to determine upon a list of trees which would have a fair chance of success under the particular conditions, for, while experimentation was a valuable element in the idea, there was, of course, no necessity for expenditure upon what experience and other knowledge of certain species said must be useless. Accordingly, Mr. Brown made out such a list, and submitted them to Baron Von Mueller, as well as to Mr. J. Ednie Brown, Director-General of Forests, New South Wales; Mr. G. Perrin, Conservator of Forests, Victoria; and Mr. D. Martin, Secretary for Agriculture. Each gave his opinion, and it is interesting to note that out of the 268 distinct species recommended, they objected to only half a dozen, and advised the additions of fifteen others. Professor Brown then selected seven acres of ground immediately south of the college building, having an eastern aspect, good virgin soil of medium texture, and abundant natural drainage. This was sub-soiled, thoroughly tilled, and fenced from rabbits. The whole space is kept free from weeds, and every attention given to each specimen, but no artificial watering whatever has been allowed. Planting is done at 25 ft. apart each way, and progress already made is such as to warrant the expectation that, in the course of a very few years, a very good arboretum will have been established in Victoria. The Council and the Secretary for Agriculture are giving Professor Brown every reasonable encouragement in the realisation of his project.—*North British Agriculturist.*

Patent Wood Fibre.

Mr. James P. Pile, builder and contractor, of the Brunswick Saw-mills and Joinery Works, 83, Great Brunswick Street, Dublin, has brought out a new "Patent Wood Fibre" which is well destined to become a useful article of Irish manufacture.

This wood fibre is, we are informed, being extensively used for bedding in many of the union workhouses and other large institutions in Ireland, and is strongly recommended as being more comfortable, cleanly, and healthy than straw. It has the further advantages of being lighter and lasting longer, while the odour of the pine renders it an essentially sanitary bed likely to be of value in hospitals and infirmaries. It is also valuable for dog bedding, the well known quantities of pinewood shavings being present in a far more efficient form.

The maker points to its efficiency for packing purposes, mineral water manufacturers and export bottlers, finding it more suited to their needs than any other material. A special fine fibre, made of pure white wood, is prepared for silversmiths, biscuit manufacturers, confectioners, &c., and another form of the pitch pine fibre has been highly approved of by many important hospitals for its antiseptic qualities.

With this addition to his building and contracting business, as well as the conduct of his saw-mills and joinery works, Mr. James P. Pile should find his trade develop to a large extent during the coming winter. There should be a large market for his patent woodfibre which can be delivered at comparatively little cost in most Irish towns and villages. (*Timber Trades Journal*).

Pice Packets of Quinine.

A few months ago we published a short account of the new arrangements by which quinine is sold at Post Offices in Bengal, the Central Provinces and elsewhere, in small packets at 1 pice each. Our readers may be interested in the following figures shewing the value of sales during 1893.

	Rs.		Rs.
January ...	189	July ...	1,305
February ...	177	August ...	3,399
March ...	207	September ...	1,990½
April ...	330	October ...	3,045½
May ...	523	November ...	4,262
June ...	872	December ...	3,402
		TOTAL Rs. ...	19,702

The number of packets actually sold was 1,446,900 which is not bad for the first year, and shews that the new scheme has 'caught on' and bids fair to be a great success.

The Brandis Prize Fund.

The Director of the Forest School at Dehra Dun has received from Sir Dietrich Brandis, K. C. I. E., a cheque for £5 as a contribution to this Fund so as, to use his own words, to "induce 'Dehra Dun students to contribute more good articles to the 'Forester' particularly on sylvicultural matters."

Sir Dietrich says that he has read with pleasure the articles to which Honoraria have already been awarded, and we hope that our readers will agree with us in thanking him for his kindness and that old Dehra Dun students will show an eager competition to profit by his bounty.

Tapping of a Para Rubber Tree in Ceylon.

A recent despatch from the Secretary of State gives an account of the tapping of a Para Rubber tree in the Henaratgoda Botanic Garden in Ceylon by Dr. H. Trimen, F. R. S. The tree was 15 years old and had a circumference of 6 feet 5 in. at 3 feet from the ground. It was tapped in 1888 and gave 1lb. 11¾ oz; in 1890, and gave 2lb. 10oz.; and in 1892 giving 2lb. 13 oz.—total 7lbs. 2¾oz. in 6 years. The rubber was valued by Messrs. Hecht Levis and Kahn of 21 Mincing Lane at 2s. 3d. to 2s. 6d. per lb. So that the annual money yield of a tree, in good climate and well cared for can be put down at 2s. 10d. and the cultivation ought to be profitable.

The Classified List of Forest Officers.

The last of these lists published was that of January, 1893 and we have long been waiting to see the next one. A recent order of the Government of India, has decided that it is now too late for the July 1st number to issue and that consequently that one will be left out. We hope that this means that the January 1st, 1894, List is to come out at once. The delay was apparently due to difficulties in the list of the combined Provinces, Punjab, Central Provinces, Berar and Coorg.

IV.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

January 1st, 1894.

EAST INDIA TEAK.—The importation of Timber and Planks has been :—

1887,	1888.	1889.
9.160 Loads	12,270 Loads	19,407 Loads ......
12,241 „	16,618 „	15,890 „ ......

And the deliveries

	1890.	1891.	1892.	1893.
Imports	16,000 Loads	16,588 Loads	7,923 Loads	12,687 Loads
Deliveries	17,140 „	14,371 „	10,455 „	12,846 „

The trade in what is probably the finest wood, for all practical and wholesale purposes, that is grown, has been disappointing in London during 1893. It is no doubt the all-prevailing desire for cheapness, regardless of quality, in a year of depressed general trade, which has prevented this wood from holding its own for general uses, and confined it, more or less exclusively, to shipbuilding and dockyard work. The importation to London has been small, and the consumption also, though the latter has been swollen by large drafts upon the London stocks for Admiralty contracts. The French blockade of Bangkok at one moment threatened to suspend the Siamese supply, but the demand was too languid for this to cause any excitement in British markets. These Siamese shipments have again held their own well with those from Burmah as regards quality and manufacture, and except for Government work the wood from the two countries is much of the same value. So long, however, as the British Admiralty officials retain their prejudice in favour of Moulmein or Rangoon Teak, the Siamese shipments must remain commercially at a disadvantage, which will be reflected in the prices obtainable. The London trade during the year has run more largely than before in the direction of sawn planks and scantling, and even of planed boards manufactured abroad.

ROSEWOOD —East India.—Considerable sales were made early in the year at reduced prices, but the demand steadily declined, and since then operations have been of a more or less retail character with a continual downward tendency in prices The import was limited to two parcels, both of which were sold ; but some lots landed in the previous year still remain on hand. Present stock, although not at all heavy, is in excess of current small demand. Quotations are from £5 to £8 per ton.

SATINWOOD.—East India.—There was a good demand for figury *logs* which realised up to 2s. 4d. per foot super, but plain wood was dull of sale ; the import was not at all heavy, but it passed very slowly into consumption and some wood still remains on hand, therefore only large and figury logs should now be sent, *Planks* and *boards*.—There were again no shipments, and they are not wanted.

EBONY.—East India.—The import, which was very light, all came *viâ* Colombo, arrived during the first half of the year. The demand was dull for several months, but with reduced stocks, and no Ceylon wood offering, sales were more readily made, without, however, any tangible advance in prices ; as there is now no stock in first hands, fresh imports of sizeable, good logs would be likely to find buyers at better figures than those last realised, but to what extent, depends very largely upon the continued scarcity of Ceylon wood. Present quotations are from £6 to £8 per ton.

PADOUK.—The imports from the Andaman Islands were again limited to two cargoes, and, as in the previous year, the chief part was transshipped to the United States. There is more enquiry here, but whilst the bulk of the import is so quickly sent away there is but little chance for an increased home trade ; nevertheless, prices have hardened, and quotations are now from 3s. to 3s. 6d. per foot cube for logs and planks.

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, January 1894.*)

Cardamoms,	per lb.	2s.	to	2s.6d.
Croton seeds	per cwt.	20s.	to	27s.6d.
Cutch	,,	20s.	to	23s.
Gum Arabic, Madras	,,	15s.	to	45s.
Gum Kino	,,	£15	to	£18
India Rubber, Assam	per lb.	1s.7d.	to	2s.3d.
,, Burma	,,	7d.	to	1s.1½d.
Myrabolams, Bombay	per cwt	9s.6d.	to	11s.3d.
,,	,,	5s.	to	6s.9s.
,, , Godavari	,,	7s.3d.	to	7s.9d.
Nux Vomica, good	,,	6s.	to	8s.
Orchella, Ceylon	,,	22s.	to	28s.
Redwood	per ton	£3.	to	£3-10s.
Sandalwood, logs	,,	£35	to	£55
,, chips	,,	£9	to	£30

Cawnpore Price Current.

January 25th, 1894.

	Per Maund.						
	R.	A.	P.		R.	A.	P.
Aonla fruits—dried	0	12	0	to	0	12	6
,, leaves dried, bruised ...	1	12	0	to	2	0	0
Babul bark	0	7	0	to	0	8	0
Bahera	1	10	0	to	1	12	0
Lac Stick	20	0	0	to	22	0	0
Myrabolams	3	0	0	to	3	8	0
Moonj grass	0	8	0	to	0	12	0
,, twine	2	0	0	to	3	0	0
Bees-wax	54	0	0	to	60	0	0
Gum Babul	12	0	0	to	13	0	0
,, Mixed	9	0	0	to	10	0	0
Nux Vomica	8	8	0	to	8	9	0

ERRATA.

No. 1.—JANUARY, 1894.

Page 1. line 12, *for* 'Olivieri' *read* 'Oliveri'
Page 9. line 30, *for* '6' *read* '5½'
„ 31, *for* '1' *read* '½'
„ 32, *for* '1' *read* '½'
„ 40, *for* 'Rs. 1-6-0' *read* 'Rs. 1-8-0'
„ 41, *for* 'Rs. 1-2-0' *read* 'Rs. 1-4-0'
Page 10. line 15, *for* 'Rs. 4-0-0' *read* 'Rs. 1-8-0'
and *for* 'Rs. 2-0-0' *read* 'Rs. 1-8-0'

No. 2.—FEBRUARY, 1894.

Page 60. line 7 from below, *for* '7 in.' *read* '3 in'

THE

INDIAN FORESTER.

Vol XX.] March, 1894. [No. 3.

Recruits for the Forest Department

II

The dearth of qualified candidates for entry to the Imperial Forest School, through which alone the Provincial Service of the Forest Department is recruited, becomes remarkable and almost unaccountable, when it is remembered how Natives come forward in shoals as *omédwars* for any and every Government appointment that falls vacant.

It used to be stated that the prospects offered by the Forest Department were not good enough. But that can no longer be said, for young men, who can pass through the School and obtain the Ranger's certificate, have an opening which compares favourably with the prospects in any career open to Natives of India. The salaries of the different grades of the Class of Ranger to which passed students are appointed direct from the School, or to which they obtain very speedy promotion, rise from Rs. 50 to Rs. 150 a month, and after an approvod service of not less than five years as Ranger, eligibility for promotion is earned to the Class of Extra Assistant Conservator on salaries ranging from Rs. 200 to Rs. 350 a month. Further, a specially selected number of these Extra Assistant Conservators, who may prove themselves competent to hold charge of the more important Divisions, have the still better prospects of advancement to the Class of Extra Deputy Conservator, of which there are four grades of salaries *viz.*, Rs 450, Rs. 500, Rs. 550 and 600 a month.

In spite of the above inducements to join the service, the number of private students who can be found to pass a simple Entrance Examination in English and Elementary Mathematics, and to defray the cost of keeping themselves during the 21 months training at Dehra, estimated at Rs. 735, remains extremely limited.

Can it be that Indian parents are too apathetic and too little alive to their children's future welfare to risk the investment of so small a sum on securing for their sons' certain employment on pay which may reach Rs. 600 a month, and from which they may eventually retire on a pension, perhaps, four or five times greater than the income they themselves (the parents) have ever enjoyed?

There are strong grounds for supposing this to be the case, since neither the dislike to a Forester's rough life, nor the fear of so elementary a test as the Entrance Examination, can be the deterrents.

Whatever may be the cause, the main recruitment of the Provincial Service, to the wonder of observant Europeans, is at present effected with difficulty and by means of

(*a*) A too low standard of Entrance Examination.

(*b*) A stipendiary inducement from Government of Rs. 30 to 50 a month during the 21 months residence at Dehra :—

whereas it might be reasonably expected that candidates would flock in from all sides ready prepared to undergo a competitive Entrance Examination and anxious to gain a Rangership at the cost of the expenses at Dehra, just as young Englishmen compete for Entrance to Coopers Hill and gain admission to that branch of the service recruited in England at an outlay little short of £2,000. Parents in India generally spend money, which they doubtless often have to borrow, on marriage and other ceremonies, which, if devoted to starting their boys in life, could not be more profitably invested than by seeing them settled in the Provincial Forest Service. If a similar service were open to competition in Europe, private tutors would no doubt come forward and earn livelihoods by coaching young men for the Entrance Examination; and it is possible that speculative individuals would do a profitable business by financing the impecunious through their term of technical training in return for a percentage of the pay of their first years.

If Natives had been taught to pay for their higher education from the beginning, this state of things might be existent here and students might be found ready not only to defray the cost of living at Dehra, but to pay for the educational advantages and render the Forest School self supporting. Now the problem of discouraging the stipendiary and of attracting the private student is by no means easy. The naturally gradual way would seem to be to reduce the stipends either in number or amount, and eventually discontinue them. But either course is beset with a serious obstacle, the former will cause a similar reduction in the number of students, and the latter will lead to students being admitted with insufficient means to maintain themselves in health and respectability while at the School.

It is thought that the present system must be continued for a number of years, until through the long process of time necessary for such conviction, native opinion comes to be convinced of the full benefits of a Forest career.

The course of training at Dehra Dun includes both practical and theoretical teaching in a wide range of subjects, and, while affording the best students the opportunity of gaining 'Honours,' and with this distinction, material advantages in the quickness of their future advancement, it is well calculated to develop in all that aptitude for forest work and keenness of observation, without which they cannot gain the further knowledge and experience necessary to make them useful officers of the service. With an institution like the Imperial Forest School, and the numbers of State-educated Natives seeking employment, it should only be necessary to bring home to these latter the advantages to be gained through the School, in order to secure an abundance of recruits for the Provincial Forest Service.

The Hill Forests of Java.

(*A translation from the Först aud Jagd Zeitung.*)

II

THE FORESTS BETWEEN 5,000 AND 8,000 FEET ELEVATION.

a. THE CLOUD ZONE OF WEST JAVA.

The forests of the moist zone are very similar both in East and West Java. If a difference exists, it is that in East Java, the number of species is not so great and the species that are represented are not those which are so dependent on excessive rainfall. But in the forest zone now under consideration the difference is very marked. In East Java this zone is covered with open forests of *Casuarina Junghuhniana*, whilst in West Java dense mixed forests cover the slopes. The principal differences between the moist forests and those in the zone immediately above them are as follows :—

1. The temperature at an elevation of 2,000 metres, (taking the average temperature at sea level to be 27·5° C and allowing 0 56° C. for each rise of 100 metres) would average 16·3° C and this is just at the elevation where the characteristics of the present zone are most marked. Variations in the average temperature are, at least in West Java, of not sufficient importance to seriously affect vegetation.

2. The intensity of direct sunlight and sun's heat should have some effect, but no exact *data* are available. As the forests are covered in this region nearly all day long by clouds, the sunlight can not have the same effect as, for example, on Alpine peaks, where this factor compensates for the low temperature of the air. Itmust, however, cause increased transpiration and evaporation .

3. Atmospheric pressure at 2,000 metres is, of course, much less than in the lower forests.

4. With regard to rain and cloud, the zone can aptly be called the "cloud zone," for, especially in the well wooded areas, heavy rolling clouds begin to form as early as 9 a. m. covering

everything in their folds till 3 p. m., when, breaking up in, sometimes, a dozen simultaneous thunder storms, they disperse and allow the evening sun to shine on the flowery canopy of the forests. If these thunderstorms do not take place, the forests remain wrapped in mist, so dense and damp that one cannot see 25 yards ahead whilst the Hygrometer stands at saturation point.

5. In spite of the continuous clouds, the actual rainfall in this zone is much less than in that immediately below it, for the saturated air sinks and deposits rain in the lower forests.

6. The relative moisture of the air is very high and sometimes reaches saturation point; but falls considerably during sunshine. In the same day the relative moisture may vary from 49° at 6 a. m. to 100° at 6 p. m.

Put concisely, the climatic characteristics of the cloud zone are as follows:—The temperature is not favorable to tropical vegetation, and tropical growth is replaced by sub-tropical and temperate vegetation. But most remarkable is the excessive humidity of the air in connection with the comparatively small rainfall; the presence in the air of a fine spray which covers all vegetation and also the soil with moisture without penetrating deeply; the occasional fine weather accompanied with a dry atmosphere, which, combined with the low atmospheric pressure and intense sun's power causes rapid transpiration and evaporation. These characteristics of climate are impressed upon the forest growth in this zone.

In East Java, the formation of cloud generally ceases during the dry season, but continues as in West Java during the wet season; a circumstance which is responsible for some differences in the conditions of vegetation in the two localities.

We can now proceed to consider the forests which exist in the cloud zone of Java. The characteristics of these forests point to the existence of a lower temperature than in those of the zone first described, although, of course, there must be an intermediate region, where tropical passes into temperate vegetation. There are fewer species present and these species are those which are formed in sub-tropical and temperate forests, they consist chiefly of *Amentacea, Lauracea and Podocarps*, the first are chiefly oaks but there are also various kinds of *Castanea, Engelhardtia and Lithocarpus Javensis*. Amongst the second are *Tetranthera, Polyadenia, Phœbe, Machilus, Persea, Daphnidium, Litsœa and Cinnamomum.* The most remarkable individuals in the forest are the varieties of *Podocarpus*, of which one—*P. cupressina*—has coniferous leaves, whilst the others such as *P. latifolia, Junghuhniana, amara*, and *bracteata*—have broad leaves. The occurrence of two palms (*Caryota propinqua* and *furfuracea*) in this zone is remarkable; they attain a height of 60-70 feet but are not frequent. The following smaller trees are common and strike the observer at once on account of the beauty of their inflorescence, *viz.*, the various kinds of *Saurauja*; and, amongst shrubs, *Rubus, Melastoma* and *Ardisia*. Further, *Ericaceæ*, which are in the lower zone epiphytic, here appear sometimes as independent trees, such as *Diplecosia diversifolia*, *Rhododendron*, (the former always epiphytic, the latter sometimes so in this zone) and *Vaccinium* and *Cyrtandra*. Amongst shrubs, the various kinds of *Strobilanthes* are most common: these throw up shoots 10 feet high and cover the surface of the soil often over large areas. In the upper part of this zone there also exists an immense *Lycopodium*, up to the present, unfortunately, unclassified; which, without being provided with special facilities for climbing, forms peculiar clumps or thickets on trees and bushes.

Bushy shoots of *Begonia robusta* are frequent in the upper portion of this zone, and specimens of *Astilbe speciosa* not unlike the European *Spiræa Aruncus* are also met with. As in the moist zone, varieties of *Impatiens* are common, but in the cloud zone the inflorescence is pale rose instead of deep carmine, and this is also observable in the flowers of *Strobilanthes*. In point of fact, in this zone, the flowers are generally small, or even almost invisible, and when large, are almost invariably white, exception to this rule occurs with epiphytes. In the moist zone, on the other hand, there is much richness and variety in the colouring of the flowers. Amongst herbs one may observe many *Rubiaceæ* (*Ophiorrhiza*), *Cruciferæ* (*Pteroneuron javanense*) all with white blossoms; besides individuals of *Sanicula*, *Elatostemma*, *Pilea*, *etc.*.

The ground in the upper part of this zone above the thickets of *Strobilanthes* is generally covered with moss and ferns and often with *Rubiaceæ* and *Nertera depressa* which is cultivated in pots in Europe on account of its peculiar creeping habit and its fine red berries. The characteristics of tree growth are not similar in the moist and cloud zones; the trees not so large in the latter, and buttressed trunks have almost disappeared, the leaves are smaller; the proportion of wood and leaf has altered in favor of the former, in fact the habits of the trees do not vary much from those of broad leaved European species. At the same time, the absence of large climbers is remarkable; whilst of epiphytes, those requiring a heavy rainfall no longer exist, especially those which take root in the ground and ultimately become trees; the woody epiphytes which still find place in this zone are mostly small and often provided with water reservoirs. Thus, the taller vegetation in this zone shows the effects of a pronounced decrease in the deposited moisture, whilst the lower vegetation remains, as in the moist zone, a growth with tender leaves and superficial roots which can exist without a heavy rainfall, provided the air is laden with moisture. The most typical examples of such vegetation are those epiphytes which grow from a surface net-work of roots; and the entirely rootless *Tillandsia usneoides*.

The branches of the trees are here veritable atmospheric gardens which produce, in the lower portion of the zone, ferns, orchids and even bushy *Ericaceæ*, but in the upper portion only mosses. The cloud zone of the Java forests might indeed be divided into two regions according to the epiphytic growth. In the upper, the luxuriance of mosses more particularly characterizes the forests.

Strobilanthes, scarcely 5 feet high, can be observed festooned with moss, even the leaves covered with a fine growth of the same; whilst from the trees over head hang flags of moss 5 feet long, so close together that it becomes impossible to see beyond a few yards, and the trunks of the trees are covered with thick layers of the same growth, which even in fine weather, stream with moisture. On these mossy coverings, epiphytes are constantly present, but only those which exist on the surface; such as *Orchids*, *Peperomia*, a few *Vaccinieæ* with their globular water cisterns, *Hymenophylla*, and other large and small ferns. But these epiphytes as compared with the luxuriance of mosses, do not specially characterize the forests of this upper region, for their true home is in the forest at a lower elevation, where the immense *Asplenium Nidus* can be seen by hundreds, and where varieties of *Lycopodium* hang from the branches in streamers of over 6 feet long. As we ascend, the water-loving species are more and more uncommon, and we reach, finally, the Alpine regions where the vegetation is quite different.

b. THE CLOUD ZONE OF EAST JAVA.

The climate of East Java is much dryer than in the West, and the vegetation in the cloud zone in the East presents a much more marked type than in the same zone in the West of the island. Rain and cloud are there not sufficient to overcome the drying effect of low pressure and insolation, and in consequence the number of species decreases and also the density of the forest. The most important tree is *Casuarina Junghuhniana*, the only tree which reaches a large size in this region, and illustrates by its scanty foliage and massive bole the effect of a dry atmosphere. Other trees, such as *Quercus pruinosa*, *Albizzia montana*, *Dodonæa viscosa* are either very small or often mere shrubs. Looking up at the five pointed pyramid which rises abruptly from a plateau of 1,500 feet elevation to a height of 10,350 feet, the existence of well defined zones is at once evident. The base of the pyramid is covered either with coffee gardens or with grassy fields; then follows a belt of forest extending from 5,600 to about 9,000 feet, which shows a series of peculiar transverse markings due to the variation in species consequent on the nature of the soil, for this holds more or less moisture according to whether it lies on the ribs or gullies which seam, with great regularity, the sides of the volcano.

The former appear black and are covered with *Casuarina*; the latter brown and support a growth of *Quercus pruinosa*. The forest belt is sharply defined both above and below. The summit of the pyramid appears of a yellow green color covered with an alpine treeless turf from which bare peaks or smoking masses of rock appear, whilst the dead craters are covered with forest growth up to their summits.

The grassy plains, at an elevation of some 4,500 feet, are due to interference, by nature or man, with the forests of the moist zone, and are not of any special interest. They are covered with various grasses and with scattered bushes of *Melastoma*, an *Albizzia* and *Parasponia parviflora*. Similar grasses and shrubs grow in the *Casuarina* forests in the lower part of this zone; whilst in the gullies various broad leaved trees are found, besides the oak already mentioned, this latter grows up to an elevation where tree vegetation finally ceases.

In the lower part of this cloud zone a few tree ferns are still found, as well as *Dodonæa montana* and *Lespedeza cytisoides* which, however, finally disappear at a still greater elevation; but the branches of the scattered *Casuarinas* are covered with thick leaved Orchids, a few small leathery ferns and lichens.

With increasing altitude the character of the *Casuarina* forests alters considerably, the trees become more numerous and higher, but yet do not form a dense forest, lichens increase in number, and a small fleshy orchid with orange and carmine flowers is noticeable. The heavy growth of grass which springs up in the lower forest no longer exists, the ground is covered with the needle-like leaves and the twigs of *Casuarina*; the vegetation peculiar to the moist zone has ceased to exist and the whole character of the forest growth approaches that of European coniferous forests. The small leaved odorous *Festuca nubigena* and *Euphorbia Rothii* (which is similar to *E. amygdaloides* of Europe) are common, bunches of dog violets, *Plantago asiatica*, white pimpernels, small *Gnaphalia* and *Pteris aquilina*, all recall European forests to us.

On the gentler slopes, vegetation becomes more vigorous and there are many bushes to be found, such as varieties of *Antennaria* (*A. saxatilis*) which sometimes attain the height of a man and the dignity of a small tree. Amongst shrubs, *Sonchus javanicus* recalls *S. arvensis* of Europe, *Valeriana javanica* reminds one of *V. officinalis* and many others are found which irresistibly carry one's thoughts back to the coniferous forests of Europe. The whole vegetation of this region points to a small rainfall with great moisture in the air; though this moisture is not nearly so great as in the corresponding zone in West Java; a fact which is fully proved by the absence here of the luxuriant growth of moss and the limited size and number of epiphytes.

(*To be continued.*)

Mixed Forests of Deodar and Blue Pine.

Enough has been said already on the bad effects attending the treatment of a pure Deodar Forest by heavy fellings in my note on Deodar in Kulu published in the *Indian Forester* for May 1893. I would try now to explain in the following pages what such fellings, if carried on in a mixed forest of deodar and pine, will result in.

Perhaps none of the conifers is so common in Kulu as is the *Pinus excelsa*—the five-needled pine of the Himalaya. It is not unfrequently found associated with the deodar and in some localities grows pure both above and below the Deodar forests. As an instance of a pure forest, may be mentioned the extensive forest of *Gathrang* above the deodar forest of Nachar in Bashahr, while *Kailidugh*, *Bakarkyara* and *Borsu* in Kulu proper, *Ramgurh*, *Shikarwa* and a good many other forests in Sahraj and *Shalanda* forest in Waziri Rupi may be mentioned as representing the forest below the deodar It is with the latter kind of pure forests I propose chiefly to deal.

All such forests are comparatively young and are generally found in the proximity of large villages and towns. It is certain that all these forests once supplied the greater part of the timber required by the villagers and the townsmen for the construction and repair of their houses and shops. Consequently, every one of them was once clean or almost clean cut.

In all those above named and other similarly situated forests, the blue pine grows at present almost pure with a very little sprinkling of deodar here and there.

It cannot be doubted, however, for a moment, that these localities are a little too low for kail and are better suited for deodar. It is probable, therefore, that these forests were once almost pure deodar ; but the heavy fellings have, in recent years, converted them into pine forests. The still existing terraces of the abandoned fields, now occupied by the pine, are a proof beyond doubt that a few occasional crops were taken off the areas thus cleared of the trees. A few saplings of the cedar and the pine which were too young to yield any good timber were left standing on such-terraces and in the fields. Such saplings served afterwards as seed bearers and are now distinctly visible, even from a distance, in all these forests.

Now, it is, I believe, a well known fact that *Pinus excelsa* bears seed at a very early age, and I have seen plants from ten to twelve years of age bearing cones. It seeds plentifully and almost every year. The seed is much lighter than that of the deodar and consequently is easily carried by the wind and scattered all over the place where, if the circumstances are favourable, it reproduces itself in great numbers. The young seedlings which thus spring up are remarkable for their very rapid growth in their early age, so that wherever there is sufficient light and air they will readily develop a strong tap root capable of forcing its way into the soil where they thus fix themselves firmly before worthless species such as *Viburnum*, *Desmodium*, *Indigofera*, *Prinsepia*, *Berberis* and straggling shrubs such as roses and brambles have time to come up and occupy the areas denuded of trees by excessive fellings and consequently exposed to light and air, which conditions are, of course, equally favourable for the growth of these inferior species. Consequently wherever, in the above forests, the fields remained uncultivated for a few successive years and wherever the slopes denuded of trees had not yet been covered with worthless growth, numerous seedlings of kail sprang up. Thus the tree gradually moved on, and with it the cultivation till the whole of the area was taken up by kail.

But such a capability of springing up is not granted to deodar. It does not, moreover, bear seed before it has attained a considerable age, and the deodar saplings which escaped the ruthless hands of the villagers were too young to bear seeds This explains at once why not a single deodar seedling came up anywhere along with those of the pine.

The occurrence of pure kail forests in the localities so well suited for the deodar may be attributed to such conditions as the above.

Now, from what has been said above, it will be understood that in a mixed forest of kail and deodar, worked for deodar, heavy fellings always favor the natural growth of kail. I am therefore of opinion that no mixed forest of deodar and pine should be heavily worked over.

In places where the young reproduction of deodar is very vigorous and the plants have firmly established themselves, every mature tree whether a deodar or a pine may be removed to give more light and air to the young seedlings. But if the young growth is scanty, the best method to work out such a forest is by improvement felling, otherwise we may convert an almost pure forest of deodar into an almost pure forest of pine.

It is true that a mixed forest of deodar and blue pine heavily worked over does not suffer to such an extent as a pure forest similarly treated does, for the reason that in a mixed forest so treated whatever is a loss to the former, is a gain to the latter, while a pure forest of deodar similarly treated may sometimes altogether disappear.

Now, the pine's gain is, later on, the Deodar's gain, as well. But the question of time has to be considered, as will be seen presently. The pine always requires space and a large amount of light. No pine seedling would ever stand shade, hence the young reproduction of pine in all these pure or almost pure and well stocked forests, is quite absent.

Deodar, on the other hand, stands shade remarkably well. This quality of deodar gives it a decided advantage over its companion. Now somehow or other the deodar is sure to get itself introduced into these forests again. Each one of these pure forests of pine will gradually be converted into a mixed forest and finally it will become one of pure deodar. But, as I have said above, such a process requires time.

I must not, at the same time, omit to mention the evil consequences resulting from the exercise of certain concessions in these forests. The manure most valued in Kulu and on which the people so much depend for the fertilization of their fields, consists of the needles of blue pine, either green or dry. The custom of lopping green branches of this pine for litter and ultimately for manure prevails mostly in *Waziri Rupi* and *Sahraj*, although it is not quite unknown in Kulu proper. The dry leaves of the pine are also collected for this purpose during the month of April, just about the time when the pine sheds its needles. Now, as has been already said, most of the forests of this pine whether pure or mixed with deodar, lie close to the villages and are, of course, daily resorted to by the people during the spring for the dead leaves. But this is exactly the time when the deodar seed begins to germinate and if it has already germinated anywhere, the seedlings are yet too young to develop a strong tap root and have hardly yet thrown off their seed cap. Consequently every deodar seedling which comes up in such forests and more especially in the places where the needles form too thick a covering for their tender tap root to pierce through to reach the soil below, is taken away with the dry leaves. It is necessary, therefore, that in order to ensure the natural or artificial reproduction of deodar in such forests, that such an injurious privilege may be stopped at least for some time after felling operations have ceased.

Another principle, however, which we must not lose sight of while treating a mixed forest of deodar and pine, is to be careful in attempts to kill the latter and other small sized trees, such as re-stock even the most ruined areas very quickly, do not allow inferior species to spring up and make the regeneration of deodar easier and cheaper.

It is, of course, very easy now to grow deodar in all these low lying and well stocked pure forests of the blue pine, but had it been tried to get rid of every pine plant in order to make room to raise the cedar at the time they had been clean, or almost clean cut, such attempts would have probably resulted in the disappearance of both these species.

Thus the more I observe, the more deeply do I feel that in order to maintain a Deodar forest, the best method to treat it, whether it is a pure or a mixed forest, is by light fellings.

KULU,
15*th June*, 1893.

MIAN MOTI SINGH.

The French Forest Department in Algeria.

An article entitled "A Lesson from Algeria" appeared some little time ago in the *Pioneer*. This article, which was taken from the *Revue des Eaux et Forêts* of the 25th February last and which contains a series of accusations against the Algerian Forest Department, is really an extract of a report drawn up by a Commission of which the late M. Jules Ferry was the president, appointed to examine into the question of the modifications required to be introduced into the legislation and organisation of the various services in Algeria. The writer concludes his article in the *Pioneer* after accepting the statements of general mismanagement, and attributing this state of affairs to the fact of Algeria being a sort of penal settlement and asylum of bad bargains, by endeavouring to draw a lesson from this for the benefit of our own Government, which he states allows one or more provinces in India to be recruited from the prizemen of Coopers Hill, and others to be regarded as receptacles for the inferior residuum, inasmuch as by a new and unnecessary rule every student has a choice of province in accordance with his place on the list. It is, as most Forest Officers will be aware of, no new rule that the writer refers to, but an old one which has just been abolished, old enough indeed, we think, to justify us in supposing that the writer of the article referred to might have heard something of it, had the disastrous results he anticipates resulted from it.

Our object, however, in this article, is not so much to discuss the application and fitness of the "Lesson from Algeria," but to say a few words in defence of the Forest Department in Algeria which, in this case, as is perhaps not altogether unprecedented in other countries, seems to have been made to bear more than its own share of the public indignation, when things were found to be working less smoothly than they should do.

Had the writer of the above mentioned article perused the subsequent numbers of the *Revue des Eaux et Forêts* he would have seen that a great many of the statements made in the report contained in the February number have since been contradicted, and many of the charges brought against the Department explained. For instance, as regards the enormous fines complained of as having been extorted from the people for, in many cases, petty offences, the figure quoted in the above mentioned report as the amount of fines realized in 1890 is 1,658,958 ft. whereas the financial returns for that year show a sum of 210,582 fr. as the total realized under this head. There is a sufficient difference between the two figures to nullify the effects of any arguments based on the former.

As regards the question of revenue and expenditure, it would appear that, with the exception of the cork oak forests which cover about one ninth of the total area of the State forests in Algeria, the greater part of the forest area is not yet capable of regular working. The climate is a hot and dry one, where strict conservation is all the more necessary, if deterioration is to be prevented, and although before the French conquest, these lands belonged to the State, according to the Mussalman law it is not astonishing that they should have suffered severely from over grazing, burning and injudicious working. The results of the protection afforded them in recent years under the management of the Forest Department, can be appreciated by comparing them with the forest lands belonging to the Communes and private estates adjoining them. A private owner could not reasonably be reproached for not deriving much pecuniary benefit from a forest, made over to him immediately after its exploitation. The utility of the State Forests in Algeria is not measurable, either, by the mere amount of revenue derived from them. Another of the results of the unreasoning and rigorous conservation complained of by the writer in the *Pioneer* is the exclusion of cattle from their accustomed pasturage. As to this, grazing, if excessive before, must necessarily have been restricted; but in one department only, that of Oran, I find a statement giving 416,540 as the number of cattle, sheep, &c, grazed in the State Forests during 1890.

There is, however, one source of revenue which does not appear to have been made the most of, and that is the cork oak forests. The realization of this revenue, however, requires a previous expenditure of a considerable sum on the operation of "démasclage," or the removal of the outer layers of so-called male cork. The delay in this matter does not appear to be entirely the fault of the Forest Department, as it was only on the repeated representations of the Department, supported by the Governor General and the Algerian deputation, that in 1885 the State allotted the necessary funds for this work. In a few years, from this source alone, the forests of Algeria should be able to cover the costs of management.

The want of exactitude in determing the respective rights of the State and the residents, complained of in the report quoted in the *Pioneer*, is a matter for which the Settlement Commission appointed for this work would appear to be more justly responsible than the Forest Department. Here, as perhaps might be found to be the case in some instances in India, boundaries seem to have been laid down without previous examination of the ground, with the result that important forest areas whose preservation should have been ensured, have been excluded from the limits of the State forests, while extensive areas of cultivated and other unsuitable land have been included in these limits. Subsequent efforts appear to have been made to reclaim some of these lands, thus improperly excluded, which have not unnaturally resulted in ill-feeling against the Department into whose charge they thus passed and it is not difficult to imagine that the inclusions above referred to, have likewise led to mutual recriminations between the Forest Department and the people concerned, especially in those cases where the lands thus included had not been properly demarcated at the time; these, in some instances, being actually occupied, and consequently the right of possession had to be respected in consideration for the people, in spite of the legal fiction declaring the land the property of the State.

The Forest Department complains of the inconsistency of its adversaries, that certain members of the "corps élus" discuss forest reforms most willingly but with a competence similar to that of a pleader discussing military manœuvres; the Algerian Press takes up the cry, enlarges on the question, and excites or amuses the public until something else occurs to occupy its attention. Thus, in 1883, nothing would suffice but that the whole of Algeria should be reafforested, to put an immediate stop to drought. In 1885 it became equally urgent to eradicate all the forest situated on the plains and lower hills, in order to encourage colonisation: and now, in 1892, a return to the ancient Arab *régime* is demanded, that the forests be turned into grazing grounds and other produce be made a secondary consideration. The prime cause of the present outcry appears, however, to lie in the resistance offered by the Forest Department to the lessees of Government Forest land acquiring proprietary right in the same. Under the old *régime*, when the forests were under the direct management of the Governor-General, considerable areas of cork oak forest were alienated, first by lease, then finally after several renewals in full proprietary right on conditions most disastrous to the State.

It is chiefly against these areas of cork-oak forest that the attacks of speculators, so called colonists and others, are directed; in 1876 a further area of some 150,000 acres of this forest was leased out for a term of years with certain provisions regarding works to be caried out by the lessees. These provisions were not fulfilled, the farmers devoting their attention to obtaining under various pretexts, renewals of their lease, in the hope that from renewal to renewal they would at last arrive by virtue of their importunity in obtaining the same proprietary right as their predecessors had done. The resistance offered to these speculators is, it is believed, one of the chief causes of the present attacks on the French Forest Service in Algeria.

We are not, of course, in a position to say how far the French Forest Department is to be held blameless for the present state of affairs; doubtless there is much to be said on both sides of the question, all we have endeavoured to do is to say a few words in its defence to set against the unqualified condemnations of it contained in the article under reference.

Note on experiments on Charcoal.

In view to furnish the Inspector General of Forests with a list of trees which are highly appreciated for charcoal burning, experiments were made in some Ranges of the South Arcot District on the charcoal yielding capacity of woods of indigenous trees. Only such woods as are generally used and appreciated by natives for charcoal making were selected. The result of the experiments will be found below.

Mode of conversion : The method adopted for converting wood into charcoal was the one generally followed by natives and it need hardly be said that it is, perhaps, the crudest and most primitive method known. The wood intended to be used is cut up into billets of convenient size and heaped up in a pit whose dimensions vary with the quantity of wood to be burnt. In the case of *thin* wood such as Kassau (*Memecylon edule*) the whole quantity, which does not exceed generally a cartload at a time, is packed in the pit and then fire is applied on all sides to the bottom layer of wood. When fire has made sufficient progress, a thick layer of green twigs and leaves is thrown over the burning mass and over it again a layer of sand or loose earth to shut out air. In the case of *thick* wood about a fourth or third of the whole quantity is first thrown into the pit and uniformly spread over the bottom. Then fire is applied and kindled with straw, dead twigs and other easily ignited stuff, and as soon as the wood catches fire and begins to burn well, the remaining quantity is thrown in and the pit allowed to remain open for 4 or 5 hours until the fire has progressed sufficiently well to ensure the burning of the whole. Then it is covered over with green twigs, leaves and earth as above noted. From time to time a pointed stick is run through the covering to ascertain whether carbonization of the wood is going on satisfactorily. If smoke and vapour come out in large quantities from the surface of the covering or through the openings made by the stick, more earth is thrown over to shut out the air. If, on the other hand, no smoke and vapour escapes through the holes or if the quantity thus escaping is so slight as to indicate that fire is going out, more air is let in by making as many openings in the covering layers as necessary. Thin wood is found to require about 40 to 50 hours to carbonize. Thick wood takes a much longer time, varying from 3 to 6 days, according to the size of the billets used ; after the whole is quite cool, the pit is opened and the charcoal taken out. Four tons of wood were converted into charcoal in my Range, and in every case it was found that a large proportion of the wood, varying from ⅛ to ¼ of the total quantity put into the pit, was left unburnt, of course the unburnt wood was again thrown into the pit and carboniezd.

STATEMENT No I.

Detailed results of experiments.

Forest Range.	Species of wood used	Quantity of wood used.	Quantity of yield of charcoal	Yield of charcoal per ton of wood.	Percentage of yield.	Cost of the whole operation calculated per ton of wood burnt.			Remarks.
		lbs.	lbs.	lbs.					
Tindivanam ...	Kassau ...	2240	498	498	22·24	2	0	0	
Virdachallam ...	do. ...	336	64	426⅔	19·01	3	5	4	
	Average ...	..	...	462⅓	20·62	2	10	8	(1)
Tindivanam ..	Karungali (Acacia sundra) ...	2240	537	537	23 98	2	0	0	
Kallakurchi ...	do. .	2240	373	373	16 64	not	giv	en	
		...	...	455	20·31	...	...	...	(2)
Tindivanam ...	Tamarind (Tamarindus indica) ...	2240	470	470	21·00	2	5	6	(3)
Tindivanam ...	Turinji (Albizzia amara) ...	2240	510	510	22·77	2	5	6	
Virdachallam ..	do. .	420	66	352	15·21	3	5	4	
Tirukoilur ..	do. ..	2240	466	466	20·80	not	given		
Kallakurchi ...	do. ...	2240	361	361	16·11	do.	do.	do.	
		...	..	421¼	18·72	2	13	5	(4)
Virdachallam ...	Karuvelam (Acacia arabica) ...	2240	387	387	17·27	3	2	0	
Kallakurchi ...	do. ...	2240	339	339	15·13	not	given		
		.	..	363	16·20	.	..	.	(5)
Tirukoilur ...	Velvelam (Acacia leucophlœa) ...	2240	392	392	17·50	not	given		(6)

Statement No. II.

Comparative average outturn of charcoal per ton of wood different kinds given in the order of highest yield.

Species of wood.	Yield of charcoal per ton of wood.	Percentage of yield.	Cost of the whole operation calculated per ton of wood burnt.			Remarks.
			Rs.	A.	P.	
Tamarind	470	21·00	2	5	6	
Kassau	462⅓	20·62	2	10	8	
Karungali	455	20·31	2	0	0	
Turinji	421¼	18·72	2	13	5	
Velvelam	392	17·50	not	given		
Karuvelam	363	16·20	3	2	0	

A comparision of the results of the experiments made in different Ranges on one and the same kind of wood show great variation in the yield of charcoal, as will be seen in statement No. 1. I am inclined to believe that this is due to mistakes made in weighing the wood and charcoal, or to omission to return unburnt remains of wood. Whatever cause it may be due to, this result cannot be taken to represent the standard yield of charcoal by the different woods dealt with ; but it may be assumed that it gives a fairly approximate idea of the charcoal yielding capacity of each species when carbonized in the local primitive fashion.

From what statement No. II shows, it may be roughly stated, making ample allowance for mistakes made in conducting the experiments, that each of the woods dealt with yields about one fifth of its weight of charcoal when manufactured in the local native method. Judging from the above one fifth results and the value of green Kiln wood in this District, it may be safely observed that charcoal burning is financially a loss here.

Charcoal making in European fashion would doubtless yield much better and more satisfactory results, and it would be really worth while and interesting to experiment on a larger and more extensive scale.

It would be interesting and instructive to study the results of experiments made in different parts of India on the subject both on the European and Native methods. I learn that charcoal is manufactured on a pretty large scale in North Arcot District in the European fashion ; if so, I hope an account of it will be published in the *Indian Forester* by some one who has a personal knowledge of it.

M. R.

GINGEE,
3rd February, 1894,

II.-CORRESPONDENCE.

Iron-making in South India.

DEAR SIR,

I enclose herewith a cutting from the *Madras Times* and I believe it would be desirable to reprint the article in the *Indian Forester*.

The writer claims for the Martin-Thomas process that it can work iron on a small scale and yet by a perfect method.

This has been the aim all along. The native furnaces on a small scale worked imperfectly with great waste of ore and fuel, and the perfect European methods were too costly and required too much fuel at one site.

I know the gas furnaces well and saw them used in Switzerland three years ago, but only for scrap iron, not for ore. I am now informed that within the last four years the ore has been *directly* transformed into mild steel by means of the gas furnaces. The temperature which these furnaces give, when the air of combustion and the gas have both been heated in brick chambers by the waste heat, is very high ; and provided that the reduction of the rich ore is successful, I can quite believe that a direct process of steel making is possible. My informant says it is and has been done, but he has not seen it done in his own presence. Now, if you would, for the present, republish this article, it might then be possible to obtain more substantial information about this direct method of steel making. Perhaps the best way of getting this information is by reading up the last few years' numbers of some periodical on Iron and Steel making. It is impossible that a new method should be successfully practised since four years without anything being reported about it in the respective professional papers. But I have no access to such papers now, as my work is in the Jungle.

H. WARTH.

Attention has been directed to the iron ores of Southern India, and it is possible that English capitalists may ere long attempt something in the way of exploiting the immense supplies of excellent ore that are present, almost everywhere in the Southern Peninsula of India. At the risk of appearing tedious, we again invite attention to the Martin-Thomas process, as being well within the reach of small capitalists, and as being the method most peculiarly adapted fer the reduction of iron minerals in a country where fuel is scarce. It will be well to give some explanation of the process and explain why it is especially adapted to India. It is this : the process does not employ any direct fuel with the ore, the fuel used is used for the production of gas, and the gas produced is not taken directly and entirely from the fuel, but is mainly derived from the atmosphere and the vapour of water. These two elements exist everywhere, and by the Martin-Thomas process and by the aid of a comparatively small amount of fuel a gas known to the French as "gaz pauvre," or "poor gas," is produced. It is called "poor" as it is not fit for lighting purposes as coal gas is, in that it contains but little oxygen. It is produced by passing steam at a low temperature over a bed of fuel that is glowing red hot. The arrangement of the Martin-Thomas furnace derives the needful steam from a pool of water that is below the grate, and the steam is made by the heat of the fire on the hearth, and by red hot cinders, &c., falling into the pool through the bars of the grate. This steam passing over the glowing surface of the fuel is decomposed in combination with the heated atmosphere into a gas, the components of which are hydrogen, carbonic oxide, and nitrogen gases. This is the "gaz pauvre" of the Martin-Thomas system. This gas, leaving the furnace which has not to be heated to anything like the temperature that is needful to reduce iron ore direct, passes into a further reservoir, from which it is again directed into the cupola or receptacle in which the ore for reduction is placed. The caloric engendered by this gas is calculated to be equal to 4,000° Fahrenheit, while the heat needful to melt iron is only 1,996°. It is a question of the consumption of fuel. In the old furnace process to get a temperature of 1,996°, fuel has to be consumed, of which only a small portion arrives at that temperature, and the waste is enormous With the Martin-Thomas process the temperature of the gas-making furnace may be very low, some 800° only, and this is the only fuel that is expended ; it is expended, as we said before, in making gas, and the main components of this gas are drawn from the air and water, and these are obtained gratis.

It only requires a little consideration to perceive the enormous advantage of this system in a country where fuel is scarce and bad, as any fuel will do to heat up the hearth. The results in gas-making are the same, whether coal or even sawdust are used, the only difference being that the hearth has to be made larger in proportion to the quality of fuel employed, that is to say, the poorer the fuel, the larger the hearth. There is no doubt that the needful gas could even be made with the aid of the country fuel known as bratties. The above is a rough explanation of the system. The peculiar adaptability of the process to Southern India consists in the fact that it need not be worked on a large scale. All attempts to make iron in Southern India have hitherto been on a large scale, and as the only available fuel in South India is wood, and that wood not very plentiful, it is obvious that a small installation, say of two tons, such as is ordinarily used in Sweden, placed in the proximity of the iron mine and at no great distance from a moderate supply of fuel would succeed where a large installation of the old type is bound to fail in consequence of the enormous area over which fuel has to be bought. The enormous amount of fuel required, the expense of burning the wood into charcoal, and the loss of valuable gases in the process, this last amounting to about 75 per cent., as four tons of wood will give only one ton of charcoal, the gases and the caloric that was contained in the wood would, if burned upon a Martin-Thomas hearth, instead of being wasted in a charcoal retort, have given 3 or 400 per cent. caloric on the hearth, and produced a gas whose co-efficient of caloric is 4,000°, and finally the haulage of charcoal from over an extended area to the iron works.

All these expenses are avoided by the small works we advocate, and they are specially within the reach of small capitalists.

A two-ton furnace could be set up for £4,000 and worked certainly 300 days in the year, and an area of 2,000 acres of casuarina would serve to keep it continually going. Small furnaces of this type dotted over the Salem or other districts where good ore is to be found, would probably succeed and it would perhaps even be profitable to erect one in Madras, where fuel is cheap and abundant, and transport the ore to the furnace. This, however, is a question of detail that anyone interested can easily work out for himself by comparing the cost of transport of the ore with the gain in price of fuel. Many writers are engaged upon the subject of Indian iron at present, and have various views, but we are firmly convinced that the above is the only process that has as yet been invented, which can be utilised successfully in Southern India. It is certainly worth more serious attention than it has as yet obtained, and this must be taken for our excuse in reverting to the subject: *gutta cavat lapidem.* We trust that by constant reiteration someone may be induced to try it.—*Madras Times.*

III.-OFFICIAL CORRESPONDENCE.

Review of Forest Administration in British India for 1891-92.

As last year, the late appearance of this Review makes it in advisable to do more than give a certain number of extracts. We have reviewed all the Reports separately and done our best to place before our readers the most interesting matters in each; and we should have liked to have finished up by recording the most important parts of the Inspector-General's very interesting summary before our 19th Volume came to an end. But it could not be helped, and while the results of 1892-93 are already under discussion, we must ask our readers to carry their thoughts back to a year that is now long past. A correspondent recently asked us to publish statistics of the area and finances of the Department. We wish we could give him the figures for January 1st 1894, but unfortunately, they are not available: we will, however quote such of these given by Mr. Ribbentrop as are likely to interest him and hope that he will forgive us if we have to carry him back to April 1st, 1892.

In Chapter I.—Section I, the *area* of the Forests under the control of the Department on that date is discussed and the figures are given in the following table. It will be noticed that Leased Forests, of which there are 836 square miles, are included.

PROVINCE.		FOREST AREA IN SQUARE MILES.				Percentage of Forests to whole area of Province.	Percentage of Reserves to whole area of Province.
Name.	Area, in square miles.	Reserved.	Protected.	Unclassed State.	TOTAL.		
Bengal ...	150,717	5,211	2,181	4,534	11,926	8	3
North-Western Provinces and Oudh ...	107,441	(a) 3,768	94	54	3.916	4	3½
Punjab ...	106 613	(b) 1,715	481	(c) 3,871	6,070	6	1½
Central Provinces ..	86,501	19 680	...	393	20,073	23	22½
Burma (Lower) ...	87,220	(d) 5.615	...	...	(d) 5,615	6½	6½
Burma (Upper) ...	77,291	(e) 1,059	(f) 16,461	...	17,520	22	1
Assam ...	45,350	3,612	912	5,455	9,959	22	8
Coorg ...	1,583	113	742	...	855	54	7
Ajmere ...	2,711	139	...	* 8	147	5	5
Baluchistan ...	...	82	...	...	82	...	...
Andamans ...	1 989	...	...	1,957	1,957	98	...
TOTAL ...	667,421	40,994	20,871	16,255	78,120	(g) 12	6
Berar ...	17,711	1,256	**1,005	2,175	4,436	25	7
Total Bengal Presidency ...	685,132	42,250	21,876	18;430	82,556	(g) 12	6
Madras ...	(h) 84 880	(i) 7,175	(j) 9,404	1,304	17.883	21	8
Bombay ...	124,352	10,318	4,209	.	14,527	11½	8
GRAND TOTAL ...	894,364	59,743	35,489	19,734	114,966	(g) 13	7

REMARKS

(a) Includes 78 square miles of *Leased* Forests.

(b) Includes 343 square miles of *Leased* Forests.

(c) Includes 224 square miles of *Leased* Forests.

(d) Includes 461 square miles of *Taungya* areas.

(e) Includes 113 square miles of *Taungya* areas.

(f) Exclusive of the area of India-rubber forest of which it is impossible to form any estimate.

(g) Baluchistan left out of account.

(h) Exclusive of the areas of Feudatory and Tributary States, Zemindaris and whole Inam villages.

(i) Includes 99 square miles of *Leased* Forests.

(j) Includes 92 square miles of *Leased* Forests.

* Village lands managed by the Department, but not yet brought under the Ajmere Forest Regulation.

**"The area of 'District Reserves."

But these 115,000 square miles under the control of the Department do not represent the whole area of forest land in possession of the State; and on the management of these further areas the Reviews says :—

" I have already pointed out in previous reviews that the 'gross extent of forest managed by the Department does not comprise the whole area of forest lands in possession of the State. 'In many instances, these lands, which are at present still outside 'the sphere of the Department, are clad with tree-forest ; in others 'they are grazing-grounds with hardly a bush on them ; and 'between these two extremes every variety is represented. It is, 'in my opinion, desirable that some of them should be brought 'under conservative forest treatment, either because they are or 'will be valuable on account of the forest-produce they are able to 'yield, or, with special reference to forests occupying hill slopes, 'for the protection of underlying cultivated lands. Some tracts, 'however, should doubtless be used primarily as grazing-grounds, 'and the tree-growth on them is of little or no importance : others 'again are either by nature intended for permanent cultivation or 'can be adapted thereto by irrigation works. Such lands must 'ultimately serve the purpose for which they are best fitted. It 'is obviously desirable, however, whatever may be the character 'of such lands and the natural growth thereon, and whatever the 'purpose which they are intended to serve, that the power of 'Government to interfere with their management should be finally 'settled, and, where this has not been efficiently secured, it can 'best be done under the Forest Law."

Section II deals with the very important question of 'Forest Settlements' and once more endeavours to explain, for the benefit of incredulous Governments, that a careful adherence to the legal arrangements provided in the various Acts and Regulations does not restrict the freedom of action of those Governments in respect to the future treatment of the area settled, or prevent them from granting concessions, or even rights, where they consider it desirable to do so. And in order to have the legal rights admitted at Settlement, the granted rights, the concessions or privileges and the standing orders to be fully recorded, the Inspector-General proposes to classify the entries in the records of each Forest under the following heads.

(1) Legal rights admitted under the forest settlement, with the necessary remarks regarding their limitation, commutation and extinction, as the case may be

(2) Rights granted by Government under section 22 of the Indian Forest Act, or corresponding sections of other forest laws, with the necessary particulars as regards duration, limitation and conditions.

(3) Temporary concessions, changeable or terminable at the will of Government, granted under rules made by the Local Government.

(4) Standing orders to the Forest Department to permit certain specific acts.

Section III on *Demarcation* gives an account of the work of the year in different provinces which is said to be satisfactory.

Section IV on *Surveys* records that 3,353 miles were topographically surveyed during the year, chiefly in the Central Provinces, Madras, Burma, Bengal and Assam at a cost of Rs. 355,000, which is rather more than 100 Rs. per square mile.

Section V on *Working Plans* contains some important remarks on the mistake made in attempting to make these Plans in too elaborate a manner. Mr Ribbentrop says :—

" It is, in my opinion, of infinitely greater importance that ex-
' tensive areas should be brought under some systematic treatment,
' with the object of securing their general inprovement, than that
' we should try to force selected working-circles into the straight
' jacket of elaborate working-plans. In certain cases, where the
' crops are specially valuable and where difficult sylvicultural pro-
' blems are to be solved in order to meet a specially large demand
' on the resources of a forest area, elaborate plans are excusable and
' even advisable ; but, in most cases, we ought to leave elaboration
' to future generations of forest officers and aim at bringing the
' bulk of the forests under a simple systematic and conservative
' management."

And we are very glad to read his remarks, for apart from the difficulty in preparation, there is the still greater difficulty to be faced of the carrying out. Until we have a complete staff of Range Officers, fully trained to observe and understand sylvicultural phenomena, it will be a great mistake to give them prescriptions of too elaborate a character to work. The proper application of the 'uniform method' would, in our opinion, be almost an impossibility until Range areas have been much reduced and competent observers have been trained, capable of exercising independant judgment in questions of reproduction.

Section VI on *Communications and Buildings* very properly draws attention to the advantage which the North-Western Provinces and Oudh have derived from the marked lead they have always taken taken in the construction and improvement of roads, and urges on other Provinces the importance of the subject "not merely in the interests of the State, as the proprietor, but in that of the consumers as well."

In Chapter II on *Protection and Improvement*, Section 1. gives an account of the number of breaches of the Forest Law during the year which came to :—

	Taken into Court.	*Compounded.*	*Proportion of convictions.*
Bengal Presidency ...	2,924	12,714	82
Madras "	8,124	3,512	75
Bombay "	1,696	16,091	78
Total	12,744	32,317	79

The Review remarks that "the majority of forest cases are 'of a trivial character when considered individually, but they 'become dangerous and sometimes destructive by their frequency"; and while advising leniency in such matters as petty thefts of dry wood, fruits, etc., whose removal does not materially affect the physical prospects of the forests, recommends strictness in dealing with such offences as illicit grazing, the destruction of young growth, the removal of humus and the like, matters which endanger the well-being of the forest estate.

Section II on *Fire Protection*, shews that of 27,938 square miles attempted, 24,046 square miles or 86 per cent were effectively protected at an average cost of 3 pies per acre.

In Section V on *Thinnings and Improvement Cuttings*, there are some interesting remarks on the necessity for operations of this character in order to remedy the bad condition of the crop in most Indian forests due to previous bad treatment. The Review points out that the judicious use of the axe is, if accompanied by a thorough protection of the forest under treatment, of greater importance than sowing or planting. This is very true, and especially so when it is considered how unsatisfactory, on the whole, have been the results of desultory works of artificial reproduction in the Indian plains. All the same, we would certainly advocate the judicious use of planting works in order to fill up blanks or to introduce the valuable kinds in places where seed givers are wanting, and the growth has been reduced to too large a proportion of the less valuable species.

Chapter III deals of the '*Working and Outturn*' and shews that the outturn of the year in timber and fuel come to 166,596,010 cubic feet in all or, taking 114,966 square miles as the total area, 1,449 cubic feet per square mile. The best outturn from Reserved Forests was in Bengal, where it amounted to 3,294 cubic feet, chiefly, we presume, from the Sundarbans.

Chapter IV gives the '*Financial Results*' of the year and shews that in 1891-92, the *gross* revenue was Rs. 154,17,010 and the *net* revenue Rs. 56,21,315, the gross revenue being distributed thus :—

(*a*)	Wood	112,46,538
(*b*)	Minor Forest Produce ...	15,35,065
(*c*)	Grazing	19,56,506
(*d*)	Revenue from forests not managed by Government	2,84,393
(*e*)	Miscellaneous	3,94,508
	Total ...	154,17,010

The figures for the Provinces were.

Province.	Revenue.	Surplus.	Deficit.	Proportion of Surplus to Gross Revenue.	Net Revenue per square per mile of land under control of Forest Department.
	Rs.	Rs.	Rs.	Per cent.	Rs.
Imperial ...	6,688	...	59,100	...	...
Bengal ...	7,69,553	3,66,623	...	46	31
North Western-Provinces and Oudh ...	17,31,514	7,73,303	...	45	197
Punjab ...	10,20,074	3,79,799	...	37	62
Central Provinces ...	13,59,900	5,55,985	...	41	28
Burma (Lower) ..	28,58,114	15,32,993	...	53	273
Burma (Upper) ...	13,27,300	9,53,441	...	72	54
Assam ...	3.36,129	68,604	...	22	7
Coorg ...	1,82,897	96,017	..	53	112
Ajmere ...	19,799	5,813	...	29	39
Baluchistan ...	20,609	...	9,888	...	...
Andamans ..	2,72,338	92,42	...	34	47
Forest School ...	1,788	..	42,559	...	..
Forest Surveys (Imperial ...	257	..	26,625	...	...
TOTAL ...	99,26,960	47,86,855	...	48	61
Berar ...	5,11,185	3,12,819	...	61	71
Forest Surveys (Berar).	...	...	...	...	...
Total Bengal Presidency ...	1,04,38,145	50,99.674	...	50	62
Madras ...	16,94,216	3,69.962	...	22	21
Bombay ...	32,84,649	13,53,192	...	41	93
GRAND TOTAL ...	1,54,17,010	67,22,828	...	44	58

The Inspector-General then proceeds to give the comparative revenue and expenditure of the last twenty years in periods of four years and the table is an interesting one for it shews a gradual decrease in the percentage of expenditure to gross revenue.

Quinquennial periods.		Gross Revenue.	Expenditure.	Percentage of Expenditure to Gross Revenue.
		Rs.	Rs.	
1866-67 to 1870-71	...	42,13,000	29,94,000	71·06
1871-72 to 1875-76	...	63,21,000	42,19,000	66·74
1876-77 to 1880-81	...	68,59,000	47,29,000	68·94
1881-82 to 1885-86	...	1,02,04,000	64.96,000	63·66
1886-87 to 1890-91	...	1,34,43,000	78,22,000	58·18

He adds " this is not entirely a matter for congratulation, as 'it tends to show that the State does not now spend sufficient of 'the annual revenue on the maintenance and enhancement of its 'forest capital."

We hope that the results will be that our Government will take steps to remedy matters, and devote larger sums to sylvicultural works of improvement, the opening out of communications and the development of minor forest industries so as to utilize the less valuable products. In some provinces, a considerable sacrifice will have to be made in introducing economy in the use of forest material and in forest grazing, for we know of some localities in which the amounts which at present are demanded from them are greater than they can give permanently: in other words, the interest is being paid out of capital.

From Chapter V. *Establishments* we extract the following :—

" The reorganization of the Upper Controlling staff provides '(apart from Upper Burma, where the reorganization has not as 'yet been completed, and excepting any new forest areas which 'in other provinces may be brought under the management in the 'Forest Department) sufficiently for the control the Department 'has to exercise. Even at the time of writing, however, 19 'vacancies exist, which to a considerable extent accounts for the 'complaints of Local Governments that the superior staff is under-'manned. The most serious question, as regards forest adminis-'tration, which has occupied the Government of India for some 'years, is the reorganization of the staff of rangers and of other 'subordinates. The importance of the reorganization of these 'establishments has been urged on the Government of India by all 'Local Governments, and has been fully recognized by the 'Imperial Government, but the sanction of the Secretary of State 'has not been obtained."

If the sanction to the improved staff is not soon received, we may look to a falling off in work and less favourable financial results. Further on, attention is drawn to the effect of this withholding of sanction on the welfare of the Imperial Forest School, for so long as no organized prospects of sufficient attraction are offered, suitable men will not come forward to study at the School and enter from it the ranks of the Department.

Tasar Silk production in the Central Provinces.

The production of tasar silk in the Central Provinces will, it is hoped, be substantially promoted by the following order issued in 1892 by the Chief Commissioner. The representations which led to the issue of these orders were supported by the result of detailed enquiries showing that the pollarding of saj (*Terminalia tomentosa*) trees required for tasar cultivation could be worked, and indeed was worked, on a proper rotation, and that the growth of the worms could be carried on year after year on limited plots or *baris*, without causing any destruction to the forests at large.

RESOLUTION.

The Commissioner of Settlements and Agriculture has represented that the production of tasar silk in these Provinces is declining, notwithstanding the issue of orders by this Administration for its encouragement in accordance with the desire of the Government of India that the production of silks indigenous to India might be promoted. The principal reason assigned by the Commissioner of Settlements and Agriculture for the decay of the industry is that the cultivation of tasar worms has been discouraged in Government Forests; and Mr. Fuller invites attention to the fact that the orders issued in Book Circular No. VI of 1883, which while prohibiting the pollarding of saj trees in Government forests where they were grown for timber, authorised the selection of tasar silk rearing grounds in tracts from which no useful timber could be expected, have had the effect of stopping the growth of tasar altogether within forest limits. It is stated that inasmuch as the industry brought in no income to Government, it has been regarded as injurious to forest interests, while the policy of the Forest Department has influenced the action of Government Officers in Court of Wards Estates, and has also had some effect on malguzars, who have latterly given fewer facilities to the tasar rearers than they used to do.

2. The proposals which Mr. Fuller makes with a view to improvng tbe tasar industry may be stated as follows :—

(1) that in second class forests the leasing out of suitable areas to Dhimars for tasar cultivation should be accepted as one of the regular incidents of forest management ;

(2) that the areas within which tasar cultivation should be permitted should be determined by the Forest Department in communication with the Agricultural Department, and it should be made known to the people that cases for tasar *baris* or farms will be given within these areas ;

(3) that the levy of a small acreage rate of one or two annas an acre might be prescribed ;

(4) that a similar policy should be followed in Court of Wards Estates, which contain forests suitable for tasar cultivation, in localties where tasar is produced.

3. The Commissioners of Divisions and the Conservators of Forests, who have been consulted on these various points are generally of opinion that the rearing of the tasar silk-worm has greatly declined of late years, and that it has entirely ceased in Government forests. They consider that the industry will thrive if facilities are afforded to the people in Government forests, and concur in the suggestion to allot suitable areas for the purpose.

The measures which are proposed commend themselves to the Chief Commissioner as reasonable, and he desires that the selection of suitable areas may be taken up without delay by the Forest Boundary Committee, consisting of each Conservator within his own circle and the Commissioner of Settlements and Agriculture as representing the Agricultural Department.

4. The decision as to the districts in which such action is both feasible and desirable must apparently depend upon climatic considerations, and the existence of a sufficient number of Dhimars, who are, with few exceptions, the only people that practise the industry. The districts which may be regarded as the home of the tasar worm are situated in the southern and eastern parts of these provinces, *viz*., Chanda, Bilaspur, Sambalpur and in a minor degree Balaghat, Seoni and Bhandara. Apparently there are plenty of Government forests in Chanda which could be utilized for the purpose, and in Sambalpur, though the area of Government forest is small, some 5,000 acres could, it is reported, be set apart for the purpose, while certain areas are also available in Bilaspur, Bhandara, Chhindwara, Seoni, and Balaghat. In the last-named district, the Conservator, Southern Circle, apprehends that the available areas may prove too damp and cold, but this is a matter which practical experience can alone determine.

In the Northern Circle, the industry is reported to be practically unimportant, and frost, hail and cold, are said to militate against the propagation of the tasar of commerce which is the product of the cold weather crop. The Conservator reports that, if Dhimars can be found to undertake cultivation in Mandla, Betul, Hoshangabad and Nimar, a sufficient area of saj forest might be made available. It may be doubted whether the Dhimars will undertake the experiment; still the Chief Commissioner considers it desirable that suitable areas of saj forest in these districts should likewise be assigned for the purpose, so that, at all events, the Administration may be freed from the reproach of destroying the industry by its forest system.

In the remaining districts, little or no cultivation appears to have been carried on at any time, and as the Dhimars are very few, no action in this direction seems called for.

5. The most convenient area for the *baris* would, in the Chief Commissioner's opinion, be about 20 acres, and this should be divided into four compartments of 5 acres each, only one of which will be under tasar in any one year. The Chief Commissioner considers that it would be advisable to charge a rent for these *baris*, as proposed by the Commissioner of Settlements and Agriculture. As at present advised, he would fix the rate at four annas per acre per annum for the land actually under crop, nothing being charged for the fallow land Or, if the people preferred it and it suited better, one anna per acre per annum might be charged for the whole *baris* of 20 acres, fallow included.

6. Apart from the action to be taken in Government forests, as indicated in paragraphs 3 and 4, the Chief Commissioner desires that early steps should be taken in the same direction in those Court of Wards Estates where there is any hope of success, *e. g.*, Phuljar and Borasambar of the Sambalpur District.

The selection of the sites for *baris* in these estates will rest with Deputy Commissioners, acting under the control and guidance of the Commissisoner of the Division

7. In conclusion, the attention of the Forest Department is invited to the proposal made by Khan Sahib Mahomed Ghouse, Forest Divisional Officer, Balaghat, that tasar *baris* should be given free of charge to Dhimars who agree to settle in Forest villages and to work for the Forest Department at the usual rate of wages during the time their services are not required in connection with tasar cultivation. This plan, if feasible, might solve, in certain localities the problem of obtaining local labour which so often gives trouble to Forest Officers, and impedes work.
—*Agricultural Ledger Series.*

IV.—REVIEWS.

Agriculture in Cuttack.

We have received a copy of an important and valuable Report by Mr. N. N. Banerjei on the agriculture of the District of Cuttack in Orissa, which must have almost exhausted the subject of the condition of the delta District of the Mahanadi.

We have examined it with great interest, and congratulate Mr Banerjei on having done such a useful and complete piece of work. Our readers will hardly care to hear much of it, however, except from the special point of view of the Forest Department. So far, there are no reserved forests in Cuttack and we are not quite sure that there are any waste lands, the property of Government, that could be reserved. But there are considerable areas of forest here and there and notably there are the delta forests on the coast, the property, we believe, chiefly, of the Maharajah of Burdwan. There must also be a good deal of forest in the Sukinda estate; and in his discussion of the question of 'Fuel supply' at page 121, the author says that that supply comes from "the jungles 'of Dompara, Harispur, Kanika, Kujang, Sukinda, Madhupur, 'Patia and other petty forest tracts" which aggregate about 513½ square miles. Mr. Banerjei quotes the price of firewood in 1873 at 200 seers per rupee, while in 1890-91 it was only 80 seers; but all the same ,he does not think that it is so much the fuel that is scarce, but that the difficulties of obtaining it have increased, chiefly through the tendency to increase cultivation at the expense of the jungles. He also remarks on the scarcity of fodder, and his suggestions for improvement, which we give *in extenso* herewith, will be read with interest, especially as they seem to us to agree with the recommendations of Dr. Voelcker.

" *Suggestions for improvement.*—In the way of improving 'the fodder-supply, I may here urge the necessity of reserving 'grazing grounds. During the settlement now in progress, large 'tracts may be set aside for fodder and pasture reserves, so that 'the evil which has converted grazing into arable land may not 'continue as it must inevitably do otherwise. It should now be 'seen that no undue proportion of waste land be brought under 'cultivation. The Government may acquire such uncultivated 'lands and reserve them, and gradually convert thorny brushwood 'or bare rock and stone into tracts covered with vegetation edible 'by cattle. Under systematic artificial care and treatment there 'seems no reason why the ultimate financial results should not 'more than cover the initial expenses that would have to be in'curred in acquiring and protecting the lands. There is a tendency 'among zimindars, natural under the economic conditions that hold 'at present, to have all their waste lands brought under cultivation. 'They offer favourable terms to induce ryots to break up the 'jungle and bring jungle land under the plough. Laudable as 'such efforts are on the part of the zimindar, in the face of the 'fodder scarcity which is making itself felt more day by day, it 'seems desirable that they should rather turn their energies to 'improving these forest lands by cutting down useless brushwood 'and planting in their place useful trees, such as the sissu or teak, 'which, in the course of ten or fifteen years, would supply wood ‘which would not only serve as valuable fuel, but be available also ‘for building purposes, or, what comes more under this chapter, ‘by doing away with the jungles altogether, no doubt at some ‘expense to themselves, and converting them into extensive pasture ‘grounds.”

With these recommendations, generally, we also agree, but we cannot help protesting, as we protested when we read Dr. Voelcker’s Report, against the fallacy of imagaining that the same area will produce both *pasture* and *improved forest growth.* The holder of a deposit account at a bank might just as easily expect to be able both to gradually withdraw his deposits and to obtain a permanent fixed income from the original capital. No one who knows the conditions of forest grazing in this country, will be so bold as to think that in a District where pasture is admittedly scarce, forest tracts can be improved or created, while at the same time they are over-run by cattle. By all means, let the Government acquire forest and waste lands ; in our opinion they ought to do so even in permanently settled Districts and still more so in Districts like Cuttack, which are liable to famine. But having done so, it will be better policy to make a sharp division and separate off and close to pasture those areas which are to produce supplies of wood and timber, while managing as pasture grounds such others as may be available, without expecting to see them produce a wood supply as well. No one who has ever seen the waste lands in Puri, the District adjoining Cuttack, can possibly imagine that any thing short of complete protection against cattle, and especially goats, can restore them to a condition of capability of supplying even small fuel, much less timber of any kind. However, it is something to find that Mr. Banerjei goes as far as he does ; for twenty years ago a native official who held such views as he has put forward, would indeed have been a rarity. We are not very sanguine that Government will accept his suggestions and carry out the proposal of acquiring waste lands to be managed partly as permanent pasture grounds, partly as closed forests for the supply of fodder grass and fuel, but it is the right thing to do, and Bengal is probably the Government which is most likely to start the work, if any do. The notion about planting looks well on paper, but it is not so easy in practice : for there are few things so difficult in India as to rear plantations on poor over-grazed land.

Chapter IX of the Report gives a list of 40 timber trees which will be useful locally, but we should hardly have called the wood of *Terminalia Belerica* white, that of *Diospyros Melanoxylon* dark red, or that of *Kydia calycina* brownish. There are also lists of food plants, fruit trees, dye plants, trees yielding oils and gums and fibres and a long and exhaustive catalogue of medicinal plants. In the final suggestions, the planting of date and areca nut palms is strongly recommended.

Annual Progress Report of State Forest Administration in New South Wales for 1892.

The report for 1891 was reviewed in our number for April last. The one before as is very much shorter, the result of orders issued to all Departments of the Colony to condense Reports and economize cost. It is thus rather easier to review.

The area of the Reserves has increased since last year to 5,694,034 acres or 8897 square miles, an increase of 146 square miles over the area last year, which we regret to have given as 7,815 square miles instead of 8,751 (see p. 148), and this in spite of a considerable reduction owing to the cancelment of 18 reserves and other excisions. It would seem that even some valuable areas are being cancelled, for the Under Secretary for Mines and Agriculture says :—

"The area of land reserved for forest purposes was reduced last year by about 88,000 acres, and I am inclined to think the area might with advantage be still further reduced. To this end steps are now being taken to ascertain to what extent the several reserves can be further curtailed without detracting from their value for the purposes of timber supply."

"It is much to be regretted that the Don Dorrigo Reserve should be cancelled for the purpose of selling the land, as about 23,000 acres cedar seedlings and rootcuttings were transplanted in this reserve, and seed beds were made. Since then, the trees have been thinned and the undergrowth cleared away. These works were commenced in 1884, and the total expenditure thereon amounts to £3,025, and the reserve is, I understand, specially adapted to the growth of cedar. In the event of land within the reserve being sold, care will, I am informed, be taken not to sell any portion that has been improved."

The Financial results of the year were as follows :—

Revenue	£16,176
Expenditure	£24,635

Deficit £8,459—but it is explained that a considerable increase has taken place in the value of capital stock and that since the Department was organized in 1877 the general credit balance in its favour amounts to £155,281. We do not quite understand these figures, any more than we quite understand how 'trees planted' and 'trees thinned' are placed in the same category. The Report says 'of the trees planted and thinned something like 95 per cent have survived and are doing well" and we should like to have this explained to us.

As usual with Colonial forest work more stress seems to be laid on the work of planting new trees, than on the management of the natural forests. An area of nearly 9,000 sq. miles (less than 3 per cent of the area of the Colony which is 310,700 square miles) of presumably natural forests of more or less value, ought to provide scope for some very interesting work in forest management; but the energies of the staff seem to be principally devoted to the plantations which are extensive and evidently good and to the rearing of large stocks of nursery plants. The chief nursery is that of Gosford, where there was a supply of 686,583 plants of all kinds, trees, shrubs, climbers, large grasses and even ornamental pot plants. The chief tree grown is the '*Pinus insignis*' and after it come the Sugar gum (*Eucalyptus corynocalyx*) the olive, English oak, cluster pine and white cedar (*Melia composita*). A considerable proportion of the trees reared (130,000) were distributed to Schools and corporate bodies for the 'Arbor day', a useful institution which was held on August 19th.

The staff of the Department, besides the Director-General, Mr. Ednie Brown, consists of a consulting Botanist, two inspecting Foresters, a 'relieving officer' (See p. 395 of Vol. XVIII—we wonder how he likes relieving the Directer General one day and an Assistant Forester the month after!), 27 Foresters, 5 Assistant Foresters, 2 Acting Foresters and office staff.

Bengal Statistics.

We have received an Official Volume of 'Agricultural Statistics for the Lower Provinces for 1891-92.' The only thing of interest to us is the area of Forest and Waste Land. That of *forest* is given as 4,550,601 acres but these are presumbly only the forests under the Department as 'Reserved' or 'Protected.' A further area of 35,862,957 acres is shown under the combined heads of (2) not available for cultivation (3) culturable Waste and (4) current fallows, but the greater part of this is presumably under the Permanent Settlement.

The Dacca District, Bengal.

We have received copy of a "Report on the system of agriculture in the Dacca District" by A. C. Sen, C.S., which we have looked through with considerable interest. It is unusual in its style and is a refreshing change from the usual dullness of such reports, being full of useful and interesting information. More especially interesting is the series of reprints of old maps of the Dacca country shewing the changes in the courses of the rivers and in physical features during the past century or more. The book has lists of the fauna of the District which are carefully compiled but would be more valuable if they had been corrected and arranged by a Zoological expert. The history of the river-bed changes is also interesting. As regards Forests, the only reference is the description of the Madhupur Jungle which occupies the high land between Dacca and Mymensingh. We have never visited this interesting piece of forest which is, we suppose, Zemindari property, for the District is under the Permanent Settlement, but we are surprised to hear that it contains gigantics trees and is infested with wild beasts. The description gives us little or no information about this Jungle and so is unsatisfactory. It would have been an interesting thing to have told us of what its vegetation consists, what are its products and its market, and how it is managed.

V.—EXTRACTS, NOTES & QUERIES.

The National Government and the National Forests in America.

In his annual message, the President of the United States commends to the attention of Congress the statements relating to forestry which are contained in the report of the Secretary of the Interior, and he adds that "the time has come when efficient 'measures should be taken for the preservation of our forests from 'indiscriminate and remediless destruction." The President might have said that this time actually arrived many years ago; and we should have been pleased if he had considered the subject of sufficient importance to warrant more than a perfunctory notice. Turning to the report of Secretary Smith, we find that he recommends legislation which may "lay the foundation for a wise and 'comprehensive forestry system to be applied to the timber on the 'public land and to the forest-reservations," and he ventures the opinion that "the creation of a forestry commission, in connection 'with the Land Office, looking towards the education and use in 'this work of men thoroughly suited for it, is already needed." We agree with the Secretary as to the urgent necessity of a commission of forest-experts, although we are hardly sure that we fully comprehend precisely what functions it is to fulfil in Mr. Smith's scheme of forest administration. Five years ago *Garden and Forest* proposed, in outline, a policy which was: (1) To withhold from sale and entry forest-lands on the national domain until a thorough examination had been made to show what timber tracts could be put upon the market without injury to the country's highest interests. Meantime in order to protect the forest, it was advised (2) that the guardianship and defense of the nations' forests should be entrusted to the army of the nation until a sufficient number of adequately trained and equipped foresters could be provided for the administration of a permanent forest-policy. In connection with this we urged (3) the appointment by the President of a Commission to examine into the condition of the forests in all their relations to agriculture, public health and water-supply, so that an intelligent determination could be reached as to what portions of the forest on the public domain should be preserved for ever, and in what manner the remainder should be disposed of. We still believe that a scheme like this was practicable and desirable. It received the approval of the American Forestry Association, at its meeting in Philadelphia, as a wise preparation for systematic and permanent forest-management. But Congress never made any pretence of considering, much less of taking action on it, and never during all these years has made one honest effort to protect and perpetuate the forest supplies and forest influences which are so essential to the common weal. Meanwhile, mile after mile of timber-lands have passed into the control of lumber-men, whose sole interest is to remove the timber as rapidly and cheaply as possible. Timber-thieves have been cutting on the public domain, and no determined effort has been made to restrain them. Fires have devastated hundreds of thousands of acres, and private herds have grazed on public lands and destroyed the undergrowth of hundreds of thousands more. And yet nothing in the way of law, and very little in the way of an increased enlightenment of public sentiment, exists to-day to prevent these ravages from continuing indefinitely. To say that there has been no advance in public knowledge on this subject, would hardly be true, for, as the forest-area narrows, the apprehensions of coming timber-famine grow, and men become thoughtful. Something, too, has been done in the way of setting apart forest-reservations in accordance with a paragraph which was adroitly or luckily slipped in at the end of a bill where it did not properly belong. Certain it is, that neither the President nor his Secretary, need have any apprehension of being considered alarmists when they assert that legislation is needed at once.

In another part of his report, Secretary Smith, in writing of the national parks and reservations, invites attention to a state of affairs which will surprise those persons who have been flattering themselves that these reservations were under the protection of the army. It seems that during the summer, many complaints were made to the Department that stockmen had been driving sheep into the reserves, destroying the herbage and setting fire to the trees. The Commissioner of the General Land Office also invited the attention of the Department to the necessity of protecting these reserves, and urged that portions of the army be detailed to look after them until Congress could make suitable provision. Accordingly, the attention of the Secretary of War was directed to the facts, and he was requested to send a sufficient number of troops to protect the reservation. This request, however, was declined because the Judge Advocate General of the Army had decided that the employment of troops in such cases and under the circumstances described would be unlawful. The reservations, therefore, remain, with the same protection which is extended to other unreserved public lands, and no more. When the attention of the Judge Advocate General was invited to the fact that officers had been already detailed to protect certain national parks and forest-reservations, he replied that such detail was clearly an oversight on the part of the War Department at that time, and he added that "there is no express authorization by the constitution 'or by Act of Congress for the troops to be used for the purpose of 'executing the laws relating to these reservations, and it is therefore 'unlawful to do so." It will be seen, therefore, that even the imperfect policing which it had been supposed a handful of cavalry could give to an area as large as some of our states, is no longer to be hoped for.

Here, certainly, is need of immediate action. Congress should not delay an hour the passage of an Act to authorize and direct the Secretary of War to make necessary details of troops to protect the national parks and reservations which have been established under an Act of Congress, or which may hereafter be set apart as public forest-reservation by the President of the United States. These reservations are the property of the people, and they have a right to demand that the army shall be used to defend this property from trespassers or intruders who destroy the woods or kill the game or in any way mar the beauty or impair the value of what has been dedicated to their use and enjoyment for ever.

The issues which now absorb public attention, and which this Congress must meet, are grave and urgent, it is true; but the wisest possible action of our representatives in regard to the tariff or the currency or taxation or our relations with foreign powers, or to all of them combined, would not do as much to advance public prosperity as would the adoption of some measure laying broad and deep foundations for a stable and efficient forest-policy. --(*Garden and Forest*)

Wood Paving.

The subject of wood paving for the streets of our large towns referred to in Volume XIV page 780, of the *Gardeners' Chronicle*, has occupied so much attention of late that a few additional remarks on the subject may be useful. So long ago as 1889, the question of the superiority of Jarrah (*Eucalyptus marginata*, not *rostrata*) over Karri (*E. diversicolor*) was contested by those who were interested in the woods being adopted by the vestries of Islington, Chelsea, and Lambeth, and by the District Board of St. Martins-in-the-Fields. The correspondence on this matter was published in the Kew Bulletin for September, 1890. Since that time, the vestry of St. Pancras has used Jarrah wood to some extent, and it has been adopted by other public bodies, notwithstanding its very high price in the first instance, as the wood arrives in this country already cut into the blocks fit for use. It is very necessary that these blocks should be cut from well seasoned and sound timber, for if they twist or warp on the voyage, they lose much of their value for a purpose where it is required that they should form a close and compact body when laid.

So recently as the 13th of last month (December) a paper was read before the Society of Arts by Mr. Lewis H. Isaacs, surveyor to the Board of Works for the Holborn District, on "Carriageway Pavements for large Cities," in which the subject of wood pavement was treated of. Referring to the work of one large company interested in promoting the application of wood for paving purposes, it is stated that the Company in question laid during the period from 1872 to 1889, 1,030,000 square yards, equal to an average of 58,000 square yards per annum, and from 1890 to 1893, 520,000 square yards or an average of 130,000 square yards per annum. Besides large areas in the Strand, Hackney, and St. George's Districts, carried out during the present year, wood paving has also been adopted in the City, Kensington, Chiswick, Kilburn and Hampstead. Leaving out of the question the subject of cost, as one of a practical character in which the readers of the *Gardeners' Chronicle* will not be specially interested, we quote Mr. Isaacs' opinion on the relative value of coniferous woods, and those of species of Eucalyptus. "Taken all round," he says, "the best wood to use for this purpose is Baltic 'red timber or yellow deal, which must be thoroughly sound and 'well-seasoned, absolutely free from sap, shake, knots, or other im-'perfections." Within the last few years there has been a strenuous endeavour to introduce denser and harder wood for paving purposes, notably Jarrah and Karri, but objection is taken to these woods that they are hard and slippery and also noisy. At a meeting of the Kensington Vestry on November 8th last, a report was submitted from the Works Committee stating that complaints had been received relative to the noise caused by the trial sections of Jarrah and Karri woods recently laid in the Brompton Road, and the Works Committee recommded that the sections of hard wood in question be removed, and creosoted deal blocks substituted therefor, and after some discussion, the recommendation was agreed to. The expense of these woods is almost prohibitive, the comparison being £10 10s. for yellow deal as against £23 10s. for Jarrah, so that Jarrah would require to last seventeen to eighteen years to be equal in price to yellow deal creosoted. Another serious disadvantage possessed by wood paving is, that it absorbs dirt and street deposits more readily than any other pavement, and gives off a sickening odour, especially under a powerful sun. So that taking all things into consideration, the future of wood blocks for paving purposes does not seem by any means ensured. In the paragraph in the *Gardeners' Chronicle* before referred to, it is stated that West Australian Red Gum is "coming to the front" for paving purposes. It would be interesting to know what species of Eucalyptus is here intended. The term Red Gum is applied to several species in Australia, the best known being *E. rostrata*, the wood of which equals Jarrah in strength and durability, but this species is not a West Australian one. The true Red Gum of West Australia is *E. calophylla*, but this wood, through used for many above-ground purposes, has a bad reputation for under ground work.—(*Gardeners' Chronicle.*)

Pension Rules of trained Officers.

In the newly issued Prospectus of the Cooper's Hill College the following occurs " The more favourable pension rules have ‘recently been extended to Officers appointed from England, who ‘are thus placed on an equality with Public Works Officers appointed from Cooper's Hill College. Any Forest Officer, who ‘has rendered not less than three years' approved service as head ‘of his department, has also been made eligible for an extra ‘pension of Rs. 1,000 per annum. '

It is very strange that the long expected orders have not issued in this country. It is tolerably clear from this that the special retirement rules of Public Works and Telegraph Officers appointed by the Secretary of State have at last been extended to Forest Officers, but of the details we know nothing and the above extract can only have been rather carelessly worded, for it can hardly be supposed that it is only the Inspector-General who is to get an extra Rs. 1,000 If the Forest Department is to be on the same footing as the others, the Inspector-General will get an extra Rs. 2,000 and Conservators of three years service Rs 1,000.

We hope the authorities will remember how many Forest Officers are anxious to hear what has been decided, and issue the orders without delay.

Impression of a duck found in a tree.

A correspondent writes to ask us to mention a curious circumstance which has happened near Ashford. Some 300 years ago a duck was seen to fly into a tree and not come out; the circumstance seemed strange and a stone was placed at the foot of the tree to record the event. The tree was recently felled and in cutting it up, the impression of a bird was found in the wood. We suppose it is quite possible that the duck may have got wedged into a hollow between two living branches which as they grew together and the animal decayed, enclosed the impression of it. But the story is a curious one all the same. We have seen a photograph of the impression, which certainly bears out the statement of its cause.

Forest Fires in France.

The *Revue des Eaux et Forêts* for September last contains an account of numerous destructive forest fires which have taken place in France during the past year. Three of these fires which occurred in the Pine Forests of the Landes in April last, have been proved to be the work of an incendiary who finally confessing his crime was sentenced at the assizes to 5 years imprisonment and has also been prohibited from living in the neighbourhood for another 5 years. In August the whole of the Pine Forest of the Solferino estate, formerly the property of the Empress Eugenie, containing some 4,500 acres of wood, was burnt; the loss is estimated at over a million francs. In the same month, destructive fires again occurred in seven different places in the Landes and over a considerable area of a forest in the Gironde. Again in September several fires are reported from the neighbourhood of Mont de-Marsan. An extensive fire also occurred in the Lot-et-Garonne destroying over 12,000 acres of pine forest in Pindères and the adjoining communes.

In the Lower Charente, too, fires have been numerous and in Provence three soldiers employed in putting out a forest fire were burnt, one of them perishing in the flames.

In Algeria, too, enormous damage has been done, the total area burnt on different occasions being estimated at 20,000 acres; indeed, so serious has the situation become in Algeria that the Governor has himself gone out to the districts from which these fires are reported.

A new tree-climbing Apparatus.

A private in a Russian regiment has, it appears, recently invented an instrument by means of which the clumsiest person can climb trees with the greatest facility. The utility of the instrument has been tested before the General of the Division, who made several soldiers fully equipped use it to climb trees and telegraph posts, stopping from time to time to fire their rifles. It is thought that in these days of smokeless powder, the instrument may be of use in the defence of certain positions.

The instrument being reported to be light and easily carried, it is possible that it may prove very useful in lopping trees prior to felling them.

Flowering and Seeding of Forest Trees.

Mr. B. B. Osmaston writes from Pilibhit that the 'Asaina' (*Terminalia tomentosa*) has this year, in his District, produced an unusually heavy crop of seed. Speaking of this tree, we may note that this year the Forest School students found it in flower in the the Dún in January, though usually it does not flower until April.

Mr F. A. Lodge writes from Kurnool that the male bamboo (*Dendrocalamus strictus*) seeded freely in the Nallamalais in 1893. The thorny bamboo (*Bambusa arundinacea*) seeded in the Seshachellam and Veligonda Hills of Cuddapah in 1891, and offsets planted out seeded at the same time as the parent clumps, but clumps that had been regularly thinned (furetage) for some years, did not seed. We should be grateful for further information and experience on this important point. Mr. R. McIntosh, writing from Cuddapah, says that both species are in flower this year. And in Burma *Dendrocalamus Brandisii*, *D. longispathus*, *Melocalamus compactiflorus* and *Thyrsostachys siamensis*, with a new, unnamed species, 'Wapyusan' are also all in flower.

In regard to bamboo seeding, it may also be noted that the big bamboos on the Rajpur road at Dehra Dún (*Dendrocalamus Hamiltonii*) are in full flower this year, while the graceful 'Chye' bamboos of the Dún Villages (*Bambusa nutans*) have also, sad to state, started flowering also.

Obituary.--R. H. C. Whittall.

It is with the greatest regret that we record the death of our old comrade of 'promotion,' the Conservator of Forests in the Punjab. Whittall was one of the eight selected candidates of the second year of the officers sent out by the Secretary of State. He had previously passed into Woolwich, but had given up the prospects of a career in the Artillery for the chances of Forest Work, and passed the Forest Department Entrance Examination in February 1869. He and the present writer and two others first spent eight months in practical work in the great forest of Haguenau in Alsace, which was then in its last year as a French possession, and was noted for its value as a training ground on account of its exceptionally well-prepared and model working plan, its beautiful woods of oak and Scots pine and its enthusiastic Inspector, M. Clément de Grandpré. From Haguenau we went to Nancy and after the usual two years, which were somewhat interrupted by the Franco-German war of 1870-71, and a brief sojourn of the two new 'promotions' in Scotland instead, Whittall passed out in 1871 and came out at once to India. He was first posted to the Dún, where his father Dr. R. Whittall, so well known to all those who frequented Mussoorie and Dehra, as the sturdy old sportsman who managed the Tea Estate of Ambari, and who, himself only died in 1890, had settled. After a few years in the Dún and the hills of Jaunsar, Whittall was transferred to Burma, where he may be said to have spent the greater part of his service. From Burma he returned to the Central Provinces, and then after acting successively as Conservator in that Province and in Oudh, he was finally posted to the Punjab, where he remained till his death, which will be greatly regretted by his many friends in the Department and out of it. Full of energy and enthusiasm he probably overtaxed his strength, for he was attacked by an abscess in the liver, which, at last, after more than one operation, carried off our old friend.

VII.—TIMBER AND PRODUCE TRADE.

The Teak Markets.

Richardson and Cruddas' Price List, Bombay. *February*, 1894.

TIMBER, VARIOUS—	Per ton of 50 cubic feet.		
Teak Logs and Beams, 1st Class, Selected	Rs.		Rs.
Under 12 in. Sidings	87	to	105
12 in. to 15 in. do.	105	to	113
Over 15 in. do.	110	to	118

	Per cubic foot.	
Teak Scantlings, cut to sizes and lengths—	Rs.	A.
Under 12 in. wide by 16 ft. long and under ...	2	14
Do any length above 16 ft. and up to 25 ft.	3	2
12 in. and over by 16 ft. long and under ...	3	2
Do. any length above 16 ft. and up to 25 ft.	3	6
Teak Sleepers and Girder Beds, cut to sizes and lengths—		
Under 12 in. wide	2	8
12 in. to 15 in. wide	2	13
Over 15 in. to 18 in. wide	3	2

Teak Boards, cut to sizes and lengths—

Under	12 in. wide by 2 in. thick and under		3	2
12 in. to	15 in. do. „ do.	do.…	3	8
15 in. to	18 in. do. „ do.	do.…	4	0

Teak Planks, cut to sizes and lengths—

Under	12 in. wide by over 2 in. to 3 in. thick		2	14
12 in. to	15 in. do. „ do. do.	do.	3	6
15 in. to	18 in. do. „ do. do.	do.	3	12

Messrs. Denny, Mott, & Dickson report:—The small dock deliveries for the month accentuate the dull state of the rolling stock demand, and there seems little prospect of any immediate improvement in this direction.

Shipbuilders, both in the United Kingdom and on the Continent, have booked some fair orders during last month, and nearly all teak cargoes afloat have been sold—partly perhaps, in consequence of such orders, and partly because of the growing conviction that a very large addition to the strength of H. M. Navy is inevitable, and cannot be covered by the 9,000 loads of teak now under contract with H. M. Admiralty, unless some battle-ships are given out to private yards which would none the less necessitate an ncreased demand for teak.

The more hopeful outlook has already caused an advance in prices at the shipping ports, and it is difficult to say to what extent shippers will carry the movement until, at least, the new naval programme has been officially declared.—(*Timber Trade Journal.*)

Churchill and Sim's Circular.

February 2nd, 1894.

East India Teak.—The month's delivery has been 425 loads against 628 loads in January last year. Recent arrivals have increased the dock stocks in London, but there has been rather more business about and prices have to some fractional extent felt the stir.

Rosewood.—Some important sales have been made, but at a reduction in prices.

Satinwood.—For large and figury logs there is some enquiry, but very little demand for plain wood, and not any for *planks* and *boards.*

Ebony—Is in better demand, and moderate shipments, of good logs, might be made.

PRICE CURRENT.

Indian Teak	per load	£9-10s.	to	£15-10s.
Satinwood	per ton	£6.	to	£12
Rosewood	,,	£5.	to	£8
Ebony	,,	£6.	to	£8

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, February 1894.*)

Cardamoms,	per ℔.	2s.	to	2s.6d.
Croton seeds	per cwt.	26s.	to	27s.6d.
Cutch	,,	20s.	to	32s.
Gum Arabic, Madras	,,	15s.	to	45s.
Gum Kino	,,	£15	to	£18
India Rubber, Assam	per ℔.	1s.7d.	to	2s.3d.
,, Burma	,,	1s.7d.	to	1s.11d.
Myrabolams, Bombay	per cwt	9s.	to	11s.
,,	,,	4s.	to	4s.9s.
,, , Godavari	,,	7s.3d.	to	7s.6d.
Nux Vomica, good	,,	8s.	to	11s.
Orchella, Ceylon	,,	22s.	to	28s.
Redwood	per ton	£3.	to	£3-10s.
Sandalwood, logs	,,	£35	to	£55
,, chips	,,	£9	to	£30

Cawnpore Price Current.

January 25th, 1894.

	Per Maund.						
	R.	A.	P.		R.	A.	P.
Aonla fruits—dried	0	12	0	to	0	12	6
,, leaves dried, bruised ...	1	12	0	to	2	0	0
Babul bark	0	7	0	to	0	8	0
Bahera	1	10	0	to	1	12	0
Lac, Stick	24	0	0	to	25	0	0
Myrabolams	3	2	0	to	3	4	0
Moonj grass	0	8	0	to	0	9	0
Gum Babul	12	0	0	to	13	0	0
,, Mixed	9	0	0	to	10	0	0

THE

INDIAN FORESTER.

Vol XX.] April, 1894. [No. 4

The Hill Forests of Java.

a.—The Vegetation on the Peaks of Java.

The highest summit in W. Java attains an elevation of 9,326 feet and forms a plateau with a central depression, the crater of an extinct volcano. This plateau is occupied by bushes 8 to 10 feet high, and is covered with a short turf, whilst the slopes 500 feet lower show a thick but not tall forest growth: below this again there follows a region where the vegetation gradually approaches that of the cloud zone.

Local influences affect the character of this region even more than the elevation, otherwise these forests might be treated of as sub-Alpine; for instance, the meadows, which, though not so marked as in East Java, should yet show in the most marked way the alpine characteristics of this area, are often found not above but below the forest limit. But these forests, on the other hand, possess the characteristics so peculiar to high elevations, namely (1) that of crooked and knotty growth, the stems being short and thick, crooked and often horizontal, with twigless branches which twist in every direction and bear a few leathery leaves at their extremities: (2) the umbrella formation of the crown, built up of many branches and scanty foliage: (3) the relative proportion of foliage and timber which in the cloud zone altered in so marked a manner, is here even still more evident and is more noticeable even than in Europe: (4) the trees are covered with thick layers of moss, but not so profusely as in the lower region; and amongst the moss a few small ferns and epiphytes, and a small red-flowered orchid with thick leathery leaves and large roots is observable. The same varieties are present, but in much greater number in the cloud region. It is difficult to recognise the various species for although the forests are not dense, the confusion of twisted boughs and dead wood is amazing.

Aralia, *Myrsine avenis*, *Vaccinium floribundum*, *Dicalyx sessilifolius* and a *Hypericum* are common, whilst the giant

Edelweiss *Anaphalis javanica* forms large bushes inside the crater. The ground is not well covered under the twisted forest growth; there is a dense layer of dead leaves from which the yellow and red spotted flowers of *Balanophora elongata* appear A few ferns, a white orchid, *Ranunculus*, bushes of a Cyperacea, some grasses and brambles, flourish here and there between the tree trunks whose bases are surrounded, when not covered with moss, with the beautiful *Nertera depressa*. In open places where the sunshine can penetrate, the vegetation is more luxuriant, and here are whole beds of *Primula imperialis*, only found on this mountain peak, which reaches a height of 3 feet and bears 3 or 4 flowering heads; other flowers such as *Sanicula montana*, *Ranunculus javanus*, *Ophelia javanica*, are also found, and the stems of *Crawfurdia* twine on the tree trunks.

The woody growth in this region attests the dryness of the atmosphere, whilst the undergrowth shows the presence of more moisture. The bushes which grow on the summit of the mountain, show, in a still more marked degree, the absence of moisture, they are generally evergreens with hard, thick, hairy leaves. The most common of these are *Anaphalis javanica* (which, however, has soft leaves) *Vaccinium varingiæfolium*, and *V. floribundum*, *Rhododendron retusum*, *Gaultheria punctata* and *leucocarpa*, *Myrsine avenis*, etc, etc; there is also a small climber *Lonicera oxylepis*.

Tree ferns (*Cyathea* and *Alsophila*) with massive stems, reach as high as these bushes, whilst these again are overtopped by specimens of *Leptospermum floribundum* whose umbrella-shaped crown is covered with white myrtle-like blossoms.

There are no Epiphytes, the bushes are only occasionally moss grown but lichens are numerous. This distinction between tree and shrub growth is, of course, attributable to the falling off in moisture in the localities where shrubs abound. Herb growth consists of *Plantago Haskarlii*, *Myriactis pilosa*, *Ophelia javanica*, etc., and of large ferns such as *Aspidium aculeatum*, *Lycopodium*, sp. The open meadow land near the crater bears scattered bushes and patches of a grey white hairy moss, (*Racomitrium*); in these fields of moss the truly Alpine *Gentiana quadrifida*, *Gnaphalium javanum* and *Veronica javanum* exist.

b.—THE VEGETATION ON THE PEAKS OF EASTERN JAVA.

The characteristics of the vegetation towards the summit of the mountains in Eastern Java are similar to these described in part 2 b. of these notes; tree growth and species remain the same up to the upper limit of vegetation, where appear *Vaccinium Miquelii* and a few Ericaceæ. With a rise in elevation the Casuarina lose in height and become gnarled and the same is the case with *Quercus pruinosa*; the boles of both these trees become shorter, the branches twisted, the crown flat, whilst the foliage diminishes greatly.

Tree growth ceases very suddenly, and forest is replaced by open meadows on which clumps of a small leaved grass flourish, this is probably *Festuca nubigena.* Between these clumps the soil is either bare or covered with the creeping small hard-leaved *Leucopogon Javanica,* which may be met with at lower elevations in the Casuarina forest, and with Festuca forms the chief vegetation of this region.

Besides these, *Alchemilla villosa* with small hairy leaves and an enormous rhizome ; *Pimpinella Pruatjan* with small stem and massive roots ; *Polygonum paniculatum, Wahlenbergia lavandulæfolia,* a small violet, and two true Alpine plants, *Gnaphalium* sp and *Gentiana quadrifida* may be observed. The only plant with a large flower is a fine *Hypericum.* In clefts in the rock and similar places, one may remark specimens of Casuarina and Vaccinium knotted and stunted by the climate. On the highest peak two shrubs, *Photinia intergrifolia* and *Coprosma sundana* exist, from whose green bell-shaped flowers the long stamen or pistil protrudes.

It will be evident that the vegetation of the mountain peaks in Java is somewhat similar to that of the Alps and Pyrenees. The diminution and final cessation of tree growth, the increase of the bole and decrease of the foliage, the presence of a crooked and twisted growth, the remarkable growth of the root—all point to the existence of an Alpine flora which formerly suffered from a rigorous climate, an excessive snow fall, and the shortness of the period of active vegetation, whereas at present on these mountains there is no break in the period of vegetation, no snow fall, and only occasional frosty nights.

We can only seek for the causes of the appearance of these characteristics of an Alpine flora in the vegetation of the mountains of Java, in the circumstances which are common both to these and European mountains. Such circumstances are the rarified air, the great power of sunlight and the dryness of the atmosphere ; all these are factors which with increasing evaporation render more difficult the supply of water necessary to plant life. A closer investigation of the anatomical structure and a comparision of Alpine vegetation with that of dry places. for instance that of deserts, proves that the requirements in moisture of trees and shrubs at the highest elevations is alone the cause of any peculiarity in structure. This is further proved by the fact that the presence of Alpine flora in Java is only noticeable where there is a great scarcity of water. Thus, in the cloud and moist zones of these forests, a number of the species present in the upper forests exist as epiphytes on the dry trunks of trees but not on the ground itself ; but are found on the ground so soon as the soil contains a large proportion of salts which necessitate a large consumption of water by the plant, as on the sea shores.

A. F. W. SCHIMPER,

(In the *Forstlich-naturwissenschaftliche Zeitschrift.*)

Seeding of Strobilanthes on the Nilgiris.

All species of Strobilanthes with the exception of three, have flowered and seeded on the grass lands and Sholas of the Nilgiris. The common Strobilanthes first began flowering in 1892 and by March 1893, the hill sides were covered with dead bushes and the ground with seeds.

The shade-loving species next commenced to flower in 1892 and the Sholas were gay with the bright, blue, pink and violet blossoms, which attracted swarms of bees from the great forests of the Wynaad. The large bee *Apis dorsata* was especially abundant, immense swarms settling on the Blue gums in Ootacamund and building their combs on them, and on every precipice along the verge of the Ghats. The honey, though fairly well flavoured, was dark and treacly looking. Most of these bees at high elevations, perished during the frosts of January and February 1893, and the ground, in places, was covered with their dead bodies.

There was a general migration of jungle fowl from the Ghat Sholas, as soon as the seed was shed, and I counted no less than 42 in one covey and 18 in another, all busy feeding on the fallen seeds.

The Sholas are now full of the dead and fallen stems and it is a work of great difficulty to force one's way through most of them. The danger from fire has been great, and it was necessary to burn off the grass round the edges of most of the Sholas to prevent fire from entering.

The ground is now covered with seedlings from 1 inch to 6 inches high.

R. M.

Forest Offences.

In its review of the administration report of the Presidency Forests for the year 1891-92, the Government of Madras, referring to the high percentage of acquittals in some of the Districts, remarks thus :—

" The figures for these Districts are most unsatisfactory and 'probably evidence, as the Board points out, trumping up of 'charges by subordinates and neglect on the part of District Forest 'Officers to enquire into cases before directing the institution of 'prosecution." The high percentage of acquittals inclines the Government to come to two conclusions, to wit, (1) that charges are trumped up by forest subordinates, and (2) that District Forest Officers do not inquire into cases before they are prosecuted.

The question of forest offences and their treatment is one of very great importance and in fact "there is no matter connected with its (Forest Department's) working that demands closer 'attention from all who are connected with its administration" as the Editor of the *Madras Mail* observes in one of his leading articles. It therefore deserves to be more fully treated than my limited knowledge and experience will allow, and I, therefore, submit the following few remarks, in the hope that some abler and more experienced Forest Officers will discuss the subject, more fully, in the pages of the *Indian Forester.*

Now, to discuss the above two conclusions of the Madras Government. As regards the first, all that I wish to say is that there are other causes than the mere falseness of a case that may account for acquittal. One of these causes is the easy tampering with the prosecution evidence. Although this explanation was deemed unsatisfactory by the Conservator, the Board and the Government, yet it is a fact that several cases fall through by this cause. For it is rare that a Forest Officer meets with a respectable and truth-loving-man in his forest when he detects an offence. It will generally be an ordinary ryot if at all, probably a neighbour of the offender, that may have witnessed the offence, and it is this man that is cited as a witness. I leave it to your readers, especially such as have frequently dealt with the detection and prosecution of forest offences personally, to say whether a ryot is likely to be favourable to the Forest Department, which he looks upon with no ill-concealed hatred and aversion, or whether he is likely to help his own neighbour, and that, too, under the pressure of his village head and of the influential members of the village, which is sure to be brought to bear upon him. If the witness is devoid of neighbourly feelings or is proof against any pressure from an influential quarter, then is applied the pressure of that charm-worker money. To secure a man who will withstand the above influences is to seek for a truth-loving and honest man, and where is the Forest Guard or his Watcher to find such a man in the midst of a forest? I have had many a true case in my short career, which fell through by this cause.

The second cause is the apathy, or rather the want of sympathy, of the Magistrate who tries the cases, with the Forest Department. As a rule, it is a Subordinate Revenue Officer, who is generally also a Magistrate, that hears Forest Offence cases. As a Revenue Officer his sympathies are more with the ryot classes than with the Forest Department, which he generally believes to be very tyrannical and oppressive. Moreover, he has reason to look upon the Forest Department with some aversion at least, for it has snatched away from him the almost unbounded control he once had over the jungles in his jurisdiction, prior to the advent of that Department. Happily, this state of feeling is gradually and rapidly subsiding under the influence of education, and a better understanding of the Forest Laws and their beneficial objects is gaining ground among Magistrates.

The third cause may be insufficiency of evidence. This is easily understood when it is remembered that a forest offence is generally committed in a forest where there are not likely to be any persons besides the forest subordinates. In many cases, the detector may be the only person who saw the commission of the offence. In such cases, only the evidence of forest subordinates will be available. It is natural that the Magistrate should feel diffident to convict a person on the uncorroborated testimony of a low paid guard or watcher, even though the case may be perfectly true.

From the foregoing, I hope I shall not be understood to offer any hostile criticisms on the remarks of the Board and Government. I am far from it, especially when I know that it is only natural that such a conclusion should be arrived at by any one who notices such a large proportion of acquittals, unless they are accompanied by a different explanation. It is unfortunate that this high percentage of acquittals was not explained fully in the District reports. My object in writing at this length on this point is simply to point out that there are circumstances other than the mere trumping up of charges that may bring about the acquittal of forest offences.

From the above remarks, I do not mean to say that Forest Subordinates are incapable of trumping up cases, although I heartily wish I could say so. On the other hand, many of these acquitted cases may have been trumped up ones. It is not altogether uncommon for forest guards who are low paid, to cook up a case against an individual who has refused them a meal or *buck-sheesh* on a festive day. But that it is a general practice is hard of belief.

The main point to consider is, how to minimize the percentage of acquittals of forest cases ? The obvious answer is to hold a preliminary inquiry into every case departmentally and if its result shows that the case is true and will stand magisterial inquiry, then only to institute prosecution. This leads to a discussion of the second conclusion at which the Government has arrived.

Now as regards inquiry into cases by District Forest Officers, the Government is pleased to believe that no such inquiries are held, and that District Forest Officers neglect their duties in this direction. It is true that preliminary enquiries are not generally made by District Forest Officers before cases are sent up to Magistrates for trial. It seems to me that this is because it is not possible for a District Forest Officer to enquire into every case in his District personally, even if he can afford time to do so, with his thousand and one other duties. It is not in one place and at one time that all the forest offences are committed in a District in the course of a year. Offences occur all round the year and in all parts of the District, and I am sure that the Board and Government would not have their District Forest Officer run about his whole District, and at all times when offences are reported, to enquire into them for reasons too obvious to require explanation. Even supposing that this were possible, what length of time would elapse between the date of detection and that of complaint to the Magistrate which could only be lodged after the District Forest Officer's enquiry into the case? For all I know, it may be several months. Cases taken to Magistrates after such long delays have fewer chances of success.

It is clear from the above remarks that it impossible for District Forest Officers to enquire into all forest offences reported to them by their subordinates before the institution of prosecutions

"Why do not then," it may be asked, the Rangers and Sub-Divisional Officers enquire into cases before they submit their subordinates' crime reports to the District Forest Officer for orders? My object in intruding upon your readers with this article and of craving a space for it in your Journal is to excite a full and exhaustive discussion of the answer to the above question. .The only answer that can at present be given to it, is that Range Officers (including Sub-Assistant Conservators who are not in independent charges of Districts) are not competent to hold inquiries into forest offences and hence the omission on their part to enquire into cases.

Taking the latest revised Rules published under section 63 (*a*) of the Madras Forest Act by the Government of Madras, we find there, that it is only District Forest Officers that are competent to summon witnesses and to hold enquiries into forest offences, &c. This means plainly that the subordinates of District Forest Officers, whatever their rank and grade, are incompetent to enquire into cases, and enquiries made by them are therefore illegal or at any rate not sanctioned by law. Someone of your readers may say "what if the Subordinates Officers are not legally empowered to 'enquire into cases; they can surely examine the parties concerned, 'take notes for their satisfaction, and report the case to their District 'Forest Officer with the result of their examination." This may be done only when parties care to appear before such officers and even if they appear, only when they answer the question truly and honestly. Supposing they refuse to appear before subordinates without a formal summons, or to answer questions put to them, or give false and incorrect information. What then? What sections of the Forest Act can be resorted to for punishing them? None at all. I doubt even if any provisions of the Penal Code can be applied to such cases. These are not mere imaginary difficulties, for I have had to report upwords of 700 cases within my short career in the Department as a Forest Ranger, and in several cases I could not secure the parties to come and say before me what they knew of them, even though I went to their villages, served written notice on them to appear before me and so on. These difficulties are more clearly and keenly felt in those places where there are half educated persons who know something of Forest *Law.*

I hope I have made it pretty clear from the foregoing remarks, that it is owing to a defect in Forest Law that cases have to be sent up to the Magistracy without any departmental preliminary inquiry into their merits, and that the existing provision to enable a departmental enquiry previous to recourse to a Court of Law is insufficient and impossible to be practically worked to the required extent. The defect I refer to is obviously the provision in the existing Forest Law empowering Range Officers and Sub-Divisional Officers *to summon parties and to enquire into forest offences.*

This leads to a consideration of the expediency and advisability of investing Forest Range Officers and Sub-Divisional Forest Officers with the powers of (1) compelling the attendence of witnesses, &c., and (2) holding inquiry into forest cases, powers which fall under section 160 and 161 of the Criminal Proceedure Code. If the Government is determined to put a stop to this high percentage of acquittals it can do so only by insisting upon the Forest Department sending only such cases for trial as are in all probability certain of conviction. To ascertain this is to institute Departmental enquiry into every case. To expect this to be done by the District Forest Officer himself personally and unaided is to expect an impossibility as has been already pointed out. It therefore comes to this that the Subordinate Executive Forest Officers must be placed in a position to conduct these preliminary enquiries by being invested with the needful legal powers. I feel no doubt that the Government would not only consider favorably a proposal to invest the Executive Subordinates with such powers but that it would also grant the same, if the matter is properly represented by the competent authority *i. e.* Conservators in consultation with Collectors. I do not in the least think that Government would object to such a proposal on the score of abuse of the powers by subordinates, for in other Departments, officers of lower rank and pay than Forest Rangers of higher grades, such as Head Constables of the Police and Sub-Inspectors of the Salt and Abkari Departments are not only invested with the power of summoning parties, but in the case of Head Constables are empowered also to hold preliminary enquiries into cases. Moreover, is it likely that the Government would show a want of confidence in its Forest Rangers and Subordinate Forest Officers of higher ranks by refusing to entrust them with these powers which can hardly be turned into weapons of oppression, when we remember that it has entrusted them with the more responsible power of arresting persons for breaches of Forest Laws.

The subject is one of much importance and deserves to be fully discussed. I hope that an earnest discussion of the subject will be started in the *Indian Forester*, and that it will bear good fruit.

KASSAU.

Influence of the removal of humus on the Vegetation of Forests.

(*Translation from the Révue des Eaux et Forêts.*)

It may be interesting to compare with the experiments carried out in the German experimental Forest Stations (vide Vol. XIX Ind For.) a scientific fact which may be found in the records of the Academie des Sciences.

M. M. Berthelot and Schlœsing, Muntz and Condon have made experiments, agreeing with each other, which show that the presence of nitrogen in the soil is exclusively due to the action of micro-organisms, microbes and moulds and that bare soil or soil destitute of organic matter does not fix nitrogen.

In a forest one has frequent opportunities of noticing how the upper layer of mould and dead leaves favours the propagation of moulds and consequently of ammoniacal fermentation. It is then easy to imagine how the removal and even the simple reversing of the layers of dead leaves not only hinders the formation of mould but even diminishes the amount of nitrogen fixed by the soil by preventing the development of micro-organisms.

The influence of the humus on the quantities of nitrogen contained in a soil is already known from experiments recorded by the Eastern Agricultural Station. The results of these experiments are as follows

PROTECTED SOIL	Kilogrs of Nitrogen per Hectare.
Upper layer ...	242
Middle "	2,110
Lower "	6,002
UNPROTECTED SOIL	
Upper layer	26
Middle "	1,073
Lower "	3,660

Young trees require more nitrogenous matter than old ones and these latter penetrate deeper into the sub-soil and lower layers which contain more nitrogen than the upper layers. For these two reasons the removal of the covering of dead leaves must necessarily have greater influence in the case of young crops.

This explains certain peculiarities which have often been noticed. For example, in such places as the neighbourhood of houses bordering on or inclosed in the forest, the small areas of coppice which have to bear the exercise of rights appertaining to proximity such as the passing to and fro of the inhabitants and their cattle and carts, invasions of poultry, &c., the same symptoms of languishing vegetation are observable.

in every case it is less vigorous than in the adjoining forest, the stems are smaller, covered with lichens, and with a feeble crown. We have the same phenomena in those parts of the forest which are nearest to villages where grazing is heaviest and this notwithstanding the fact that here as in other parts of the forest grazing is prohibited until the coppice is 10 or 12 years old and that the dead leaves are not removed. It is simply that the surface covering of the soil is constantly being disturbed, kicked up and scattered about by the passing and repassing of men and cattle, and moving about is easy in these crops where the undergrowth is scarce. The result is no rotting or production of moulds, and at the same time little nitrogen and little vigour.

This reminds us of a petition addressed to the Chamber of Deputies about 1884 or 85 by the mayors of the arrondissement of Graz. Among other things the municipalities asked that the coppices might be thrown open to grazing after the age of 5 years, a practice which would carry with it the advantage of cleaning the young crops and destroying the parasites. Perhaps now that the most celebrated chemists of France are on his side, people will now listen more willingly to the Forest Officer when he endeavours to protect these same desirable "parasites."*

L. DETRIC,

---

* Strictly 'saprophytes' in the Rèvue des Eaux and Forêts.

II.-CORRESPONDENCE.

The law of Property in cases of Erosion.

Sir,

Your correspondent "G. E. M.," in the February number, raises an interesting question as to the law of property in the case of changes created by the shifting of the course of rivers.

Whatever may be the Indian or English law on the subject, I believe I am right in saying that the French law agrees with what he refers to as the "rules in force," the effect being that any extension of a property bordering on a river by reason of a change of course on the part of the river, becomes a part of that property, while the corresponding area cut off from the property on the opposite side of the river, becomes lost to that property, and, of course, if the river goes back again, the properties return respectively to their original areas.

Supposing this to be the law, its result is clear enough so long as only a portion of any particular property is cut off. As to the particular cases he cites, in which the whole of a property is cut off, I cannot say what the position would be on the return of the river to its original course. However, I would suggest the following as the course the ousted proprietor might take.

It may be supposed that the principle applies only to properties which border the river, and so, that claim to accretion can be only on the ground that the river is the boundary of the property. Then it would follow that the owner of a property not originally extending to the river, but which, on the river changing its course, actually touches it, would have no ground for saying, when the river returned to its original course, that the reverse accretion belonged to him, for that would be tantamount to alleging that the river was the boundary of his property. If then he took possession of such accretion, the ousted proprietor could dispute such possesion and call upon the interloper to establish his right. It would then appear that the river was not the boundary of his property, (but some other line which could be determined) and consequently (unless, of course, a question of prescription came in) that he had no title to the property that existed before the river shifted.

There would then be nothing to prevent the ousted proprietor resuming possession.

The fact of title to such property, consisting of a notification under the Forest Act, seems to be beside the question, in fact the law on the subject would be general and not dependent upon the nature of the property or of the proprietor's title, and in the case of a Reserved Forest, there would be nothing to be done but to alter its area in the Departmental records (keeping it still on the list, though the area came down to zero) indeed, if the original notification were modified, as your correspondent implies ought to be done, any portion cut off would be practically disafforested and would be left without a definite owner on the river retiring, and this would necessitate a Settlement before it could be treated as Reserved Forest again.

In regard to the 'centre of the earth' theory, is not that merely a subsidiary principle in the regulation of the rights of property, applicable only when the proprietor is in possession of the surface to begin with?

P. and P.

Age of Indian Forest Trees.

Sir,

I have searched several books without being able to find much about the longevity and age of maturity of Indian trees.

Can you enlighten me with regard to the following?

Acacia Sundra.
Hardwickia binata.
Chloroxylon Swietenia.
Anogeissus latifolia.
Borassus flabelliformis.

With regard to the latter, I hear that in one district the age of maturity is considered to be 50 years, and the forest is being treated on a 50 years rotation; local enquiry, however, seems to declare 75 to be the age of maturity.

But another question that I wish to ask is how are you to know whether a palmyra is 50, 60 or 75 years of age: the natives here say that the wood is harder and better at that age, but is there any real means of proving the age?

It has been suggested that the leaves sprout periodically, and that by the number of scars in a straight line up the trunk you can tell the age. Is this so? And to what period do the scars tally?

A. W. LUSHINGTON.

Percentage of Higher forest appointments in Bombay

Sir,

I wonder no one else has thought it necessary to address you on this subject. A glance at the latest Bombay Civil List discloses the fact that there are in all 31 appointments in the Imperial Service of the Bombay Presidency, including Sind, and only *two* with salaries of Rs. 1,000 per mensem and over.

This shows a percentage of plums at 6.50. Comparing the P. W. D., it is found, there are 89 appointments and 26 carrying with them salaries of Rs. 1,000 and over: (there are two appointments of over Rs. 2,000) making the percentage of plums at 29·21. Why should there be this glaring difference? Is it not necessary that something should be done to remedy the present unsatisfactory state of things? There does not exist that *esprit de corps* in the Forest which prevails in the P. W. D., a want which, it is feared, will damage the interests of the former very considerably in the future, and which is the main reason why the prospects in the present are so poor. Let there be agitation for improved prospects in Bombay where the percentage of plums are so inferior as compared to the P. W D., not to mention the Police, which possesses a percentage of 10·63, including the appointment of Commissioner of Police, Bombay.

CRITIC.

February 21st, 1894.

NOTE.—We feel sure that the sympathies of the Department will be with our Bombay comrades in this matter. We never could understand why the Northern and Sind Circles of Bombay were not considered fit for Conservators' appointments. To give those officers the pay of 3rd Grade Conservators instead of that of 1st Grade Deputies would only cost an extra Rs. 400 monthly and the money might possibly be saved in other ways.

HON. ED.

Reduction of the Imperial Forest Service.

SIR,

Re the absorption of appointments from the INDIAN FOREST SERVICE to the PROVINCIAL FOREST SERVICE in accordance with Section 19 of the Forest Departmental Code 4th edition.

It will be noticed in the half-yearly List of Forest Officers for 1st January 1894, just published, that a 4th grade Deputy Conservatorship on Rs. 550 is to be absorbed from the Punjab-Central Provinces-Berar-Coorg list to the Central Provinces Provincial Forest Service to supply a 4th grade Extra Deputy Conservatorship on Rs. 450.

Is there any reason why a 1st grade Assistant Conservatorship on Rs. 450 only should be done away with on the list to supply the 4th grade Extra Deputy Conservatorship on Rs. 450? If there is not, surely it would not be quite so hard on the officers on a list in which promotion is already so slow, if only the 1st grade Assistant Conservatorship were done away with instead of the 4th grade Deputy Conservatorship.

If it is to be the rule otherwise, we may expect next to see the few 1st grade Deputy Conservatorships on Rs. 900 being absorbed into the Provincial Service to make 1st grade Extra Deputy Conservatorships on Rs. 600, whereas a 3rd grade Deputy Conservatorship would more than supply the needful money.

Either way would apparently be in accordance with the Code.

NA-UMMED.

Pension Rules of Forest Officers.

Sir,

May I ask attention to para. 17 of the Regulations for the Forest Service Branch of the Royal Indian Engineering College, Coopers Hill, for 1894, as recently circulated to us by the Government of India. It is thus stated:—

"The more favourable pension rules have recently been extended to Forest officers appointed from England, *who are thus placed on an equality with* Public Works Officers appointed from 'Coopers Hill College. Any Forest Officer, who has rendered not 'less than three years' approved service at the *head of his department*, 'has *also* been made eligible for an extra pension of Rs. 1,000 per 'annum." The italicised words are those to which I would invite attention, and I would ask who can place faith in a Government that thus deliberately stretches the facts in what is practically a public advertisement to catch recruits.

The facts, of course, are well known to us out here, and these are that the more favourable pension rules, as extended to the Forest Department, do *not* place the Department on an equality with the Public Works Department. Conservators are graded in the matter of pay with Superintending Engineers, and under Article 714 (*b*) of the Civil Service Regulations, Superintending Engineers of 3 years service, as such, are entitled to an extra Rs. 1,000 per annum pension—but in this Department this will only be given to the "head" of the Department, the Inspector-General, who is graded as a Chief Engineer in the Public Works Department (the Chief Engineer being entitled to an extra Rs. 2,000 per annum) but will only get Rs. 1,000 as an extra pension. I suppose there must be a specially clever man somewhere at home who can show and believes that there are no differences at all, and that man ought to be brought out here to solve the Currency question.

F. O. B.

III. OFFICIAL PAPERS, CORRESPONDENCE, ETC.

Note on Extraction of Agave Americana Fibre at Coimbatore.

When on tour in the Madras Presidency in 1892 I was much struck with the excellent quality of the fibre of *Agave americana*, which was exposed for sale in many shops in the Coimbatore bazar.

A small quantity of the fibre was sent for report to the Imperial Institute, in connection with which I was at that time engaged in the investigation of fibres of Indian production which are, or might be, utilized for brush manufacture.*

Quite recently, the Madras Agri-Horticultural Society received a communication from Dr. T. Cooke, Technical Sub-Director of the Imperial Institute, South Kensington, stating that fibre of *Agave americana* (grown, I take it in the gardens at Madras) has been very well reported on, and is considered to be nearly as good as Manilla hemp.

The only specimens of fibre of *Agave americana* which were sent to the Imperial Institute from the Madras Presidency were those obtained by myself at Coimbatore, which must be those which have been thus favorably reported on.

Dr. Cooke's letter to the Agri-Horticultural Society was communicated to me, together with a series of questions by a fibre expert, I accordingly deputed the Museum Herbarium Keeper to visit Coimbatore and gave him specific instructions as to the nature of the inquiries which he was to make. The result of his inquiries *in loco* is embodied in the following note—

Agave americana grows in all soils (red, black and gravel) in the Coimbatore district. It is planted extensively as a protective hedge along the Madras Railway line, and flourishes, in the open, freely exposed to the sun, and unsheltered by trees, shrubs, &c. In some places between Coimbatore and Erode where the agave is overgrown with creepers, the plants are unhealthy; and in other places (*e.g.*, near Tudiyalur), plants which are shaded by tamarind, nim and other trees, are stunted, while those which grow in the open, are rich in leaves and luxuriant in growth.

The age of the plants from which the leaves are taken for fibre is six to seven years. The old green leaves falling outwards from the central stem are cut for fibre.

The fibre is, as a general rule, extracted immediately after the leaves have been cut, or after a lapse of a few hours. Sometimes, however, the leaves are kept for a day or two and the fibre is extracted when the people have leisure.

The extraction of the fibre is performed by hand and no machinery is used. The fibre is extracted by two methods, *viz.* (*a*) scraping and (*b*) maceration.

(*a*) *Scraping.*—The leaves are cut, the sharp spines removed with a knife, and about six inches cut off for the top of the leaf. The leaf is then split longitudinally into four or five pieces, which are beaten with a wooden mallet and placed on a board 4′×4″×3″ held firmly by the toes. The pulp is then removed by means of a bamboo scraper, one edge of which is shaped in the form of a blade, and the fibre dried by exposure to the sun.

---

* See Imperial Institute, *Hand-book of Commercial Products*, No. 12, Fibres used for Brush-making.

The fibre obtained by this simple process without washing or bleaching is very clean and free from pulp. The staple is not, however, very long. It is made into thread, which is used in weaving grass mats.

(*b*) *Maceration.*—As in the previous method of fibre-extraction, the leaves are cut, and the spines removed. The whole leaf is then beaten with a wooden mallet, and thrown in bundles into tanks or wells, in which it is left to macerate for a fortnight to twenty days, or until the pulp is quite decomposed. The bundles are then taken out, dried and bleached in the sun.

The fibre obtained by this process is longer than that obtained by scraping, but is not nearly so clean.

A very large suppy of the fibre could be obtained, if a demand for it arose. At present it is sold in the bazar at the rate of 2 annas per lb., but if a regular trade in it were started, the price would doubtless be reduced.

The mean temperature of Coimbatore is 78° ranging between a maximum of 97° and a minimum of 64°. The annual rainfall of Coimbatore is about 21 inches, of which half falls during the north-east monsoon (October to December), the remainder being distributed over the other months of the year.

(Sd). EDGAR THURSTON,
Superintendent, Govt. Central Museum.

Riding Instruction for Dehra Dun Students.

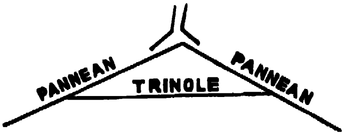
The following Letter has been circulated by the Government of India.

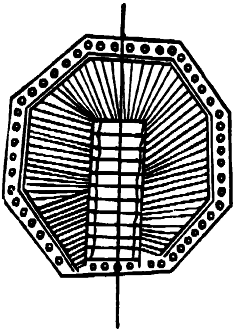
" SIR,

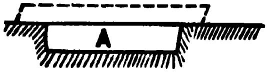
'The Board of Control for the Imperial Forest School at Dehra 'Dun have urged upon the Government of India the desirability of 'arranging for a course of riding-lessons for all students at the 'School, and they have also represented the advantages to be de-'rived by students becoming members of the Dehra Dun Mounted 'Volunteers.

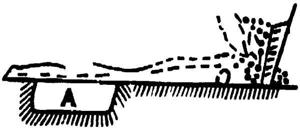
'2 Hitherto only those students who were able to enrol them-'selves as members of the Mounted Rifles have had the advantage 'of instruction in riding, and it is mainly due to the aid given by 'the officers of the Corps and of the School that the necessary 'horses have been forthcoming for these students. There is reason 'to believe that this arrangement cannot be continued much longer 'in consequence of the heavy expense entailed.

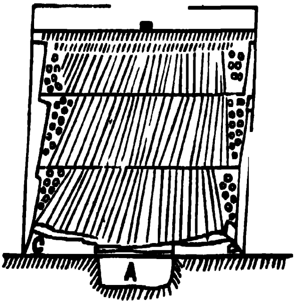
THE MOREAU PATTERN CHARCOAL KILN.











3. The Government of India in the Military Department have 'for disposal every year a number of cast-horses which are usually 'sold off in April. It has been suggested that an arrangement 'could be made under which a sufficient number of them could be 'kept at the School for the use of the students from April to 'December, and then sold It is believed that they would realize 'possibly better prices if sold at that season.

4. It is estimated that 32 horses made available for the eight 'months would cost in feed and keep Rs. 4,000 or Rs. 5,000, and 'the question before Government is whether, with the object of giv'ing the opportunity to all students to become proficient in riding 'and of encouraging as many as possible of them to become mem'bers of the Volunteer Corps, and thus to learn riding under a 'system of military discipline, such an expenditure is desirable. 'Before coming to a decision, the Government of India desires to 'learn the views of Local Governments and Administrations on the 'subject, and I am to ask for an early expression of opinion and to 'enquire whether the share of expenditure would be accepted by 'the Local Government as a charge against the provincial forest 'accounts. It would in no province amount to Rs. 1,000 in the year.

5. I am to say that if Local Governments and Administrations 'are in favour of the proposal of the Board of Control, the Govern'ment of India will take the question under such favourable consi'deration as they can accord to it."

E. C. BUCK,
Secretary to the Government of India.

The Moreau Pattern Charcoal Kiln.

Description.—The Moreau oven is constructed entirely of sheet iron having the form of a right octagonal prism composed of eight panels 2 M 50 c/m (8·2 ft.) in height by 1 M. wide (3·28 ft).

These panels are fastened together by means of key bolts which fasten brackets rivetted round the edge of each one of them.

One of these panels is cut into two parts near the middle of its height; this is the "door panel" which facilitates the putting in of the wood. The two perpendicular panels forming the door are reunited by two solid T. irons supporting the four plates constituting the lid of the oven. These plates which rest simply on the T. irons and on the brackets fixed to the top part of the panels leave in the centre a hole about 50 c/m square which is closed with a lid of thin sheet iron provided with a handle; they have besides 4 round holes called "Buses" which are also closed with little plates of sheet iron.

Four of the panels diametrically opposite have on the outside chimneys communicating with the interior of the apparatus through the bottom by means of a rectangular opening.

In the axis of the chimneys are iron rods provided with funnels. The lower extremity of these rods is fixed in pieces of wood forming supports.

At the bottom part of each panel there are two air pipes in the form of funnels. In each of these 16 funnels is placed a globular ball pierced with a conical hole into which penetrates a piece of wood placed in the interior of the oven ; when this branch or piece of wood is carbonized it breaks, the ball falls to the bottom of the funnel thus making an automatical closure.

The closure of the chimneys is worked automatically in the same manner.

Carbonisation.—The carbonisation of the wood by the Moreau process consists of seven operations which must succeed each other in the following order.

1. Preparing the ground.
2. Fixing up the oven.
3. Choice and dimensions of the wood.
4. Filling the oven.
5. Putting in the fire ; heating it.
6. Cleansing and extinguishing.
7. Emptying the oven.

1. *Preparing the ground.*—The ground must be level and on the natural soil, the mole holes must be well stopped up so as to prevent the air from coming in.

A trench must be dug in the centre of the ground occupied by each oven, this trench must be long enough to be able to introduce from the outside the necessary charcoal for lighting it. If, after several bakings, the soil of the ground becomes too dry or too hot it should be watered, or sprinkled with green grass or wet moss, otherwise there is a danger of having very soft charcoal.

2. *Fixing up the Oven*—The apparatus is fixed by means of 16 rods of 50 c/m (of which 8 are at the top and 8 at the bottom). A series of rods serve for setting up all the ovens, these rods are provided with hooks fixing into screw rings rivetted to the panels. The latter are thus kept in their vertical position and in the inclination which they must have one with regard to the other in order to form an octagonal section of a prism ; the junction is completed by means of little key-bolts, the rods are then taken away. The seams must be stopped up with earth as well as possible.

The foot of the oven is surrounded with dry earth as the smoke ought only to come through the chimneys, care must be taken that they are not stopped up. This can be ascertained by passing through them the handle of a shovel and seeing that it goes freely to the bottom. The little pieces of wood supporting the clappers of the chimneys ought not to be more than 12c/m in height by 3 to 4 c/m in diameter. Those pieces of wood in the balls must be 1 c/m in diameter by the necessary length.

The clappers of the chimneys must enter into them a few centimetres and their plain sides must be laid against the face of the panels.

3. *Choice and dimensions of wood.*—To obtain charcoal of a good quality consistent with a good yield, it is necessary to split the wood more than 6 to 7 (2¾ inches) centimetres of its diameter, and if possible it must not be baked until after it has been felled three months.

Rotten wood must never be used for carbonisation.

4. *Filling the Oven.*—The apparatus having been well cleaned and examined, if the soil be hot and dry a few leaves or some wet moss should be spread over it and once or twice sprinkled with water ; the floor of the oven must then be formed.

Place on the lighting trench a series of pieces of wood and all round pieces slightly inclined and radiating around the centre.

Above the floor, which must be about 15 c/m thick, place the logs of wood starting from the centre and proceeding to the circumference. It is essential to take a special disposition in the conical zone which the wood leaves between the different beds and the walls of the oven in order to allow the products of the condensation, the tar, &c., to flow away and at the same time to allow the gas and fumes to escape.

In order to effect this, place at the back of each panel 6 or 7 pieces of wood of medium size and as straight as possible and fill the intervening space with logs of wood placed horizontally.

The inferior wood must be placed as far as possible in the first row and on the floor.

The first row being finished, the bottom panel door is put into its place. The two other rows must then be arranged : on the top of the last row, place rather damp leaves, moss, or litter, which must be of 8 to 10 c/m in thickness. The T irons are then put into place and on the top the iron sheets forming the roof of the oven.

5. *Putting in the fire : heating it.*—Lighting and heating it ought not to extend beyond 4 hours (by heating it, is meant the heating of the oven from top to bottom). A good heat gives always a good baking.

To succeed in these operations, the fire may be allowed to give a certain intensity of heat at first without fear of evil result. It is well to obtain as much white smoke as possible which must have exit wherever it is produced : yellow, gray or blue smoke must be stopped as soon as produced by progressively closing the manhole and the lighting hole.

Light by means of an iron spoon on which is placed well lighted charcoal, which must be put in as far as the centre, through the lighting trench.

When the fire has well caught, so that the smoke comes out freely through the manhole and the holes called the buses (the chimneys are closed until they are required to draw a little), half close with earth the entrance to the lighting trench only enough to moderate the fire a little, which is soon ascertained by the colour of the smoke. In short, it is necessary to be careful that at the commencement of the operation as much white smoke as possible is produced.

At the end of an hour or an hour and a half, see that the fire is not above nor in the centre; for this purpose try to push into this place a pole, and if it penetrates this mass, it is certain the fire is above, then make what is known as the covering. For this purpose close quite hermetically the buses, airpipes, and chimneys except the manhole; by means of a strong pole, enlarge from top to bottom the hole in the centre and fill it with little pieces of wood cut 10 c/m in length, as fast as the hole fills, ram in heavily these little pieces of wood and on the top place a few handfuls of litter and a little coal dust.

This operation must be performed very quickly, it requires each time about a hectolitre of cut wood.

Arrange the oven as it was before the operation and continue the heating by closing progressively the openings, with the exception of the air pipes. If the chimneys can draw, open them with regard to the little buses shut those which smoke yellow grey or blue; but the one which is on the side of the door, must not be closed more than possible till about 2 hours after heating. If obliged to close it, it should be reopened a short time afterwards.

The cones should not be placed on the chimneys until 15 hours after lighting.

The man hole being closed and the chimneys smoking strongly, which generally happens 1½ hours after lighting, nothing remains open but the chimneys, air pipes, and a part of the lighting hole.

Two and a half hours after lighting the fire arriving at about 25 c/m from the lighting hole, the latter must be entirely closed, but if the smoke should diminish in quantity, it would be necessary to reopen it a little for about an hour.

Four hours after lighting, the oven is heated from top to bottom, all the fissures must be closed with earth and the chimneys filled with earth up to 50 c/m above the soil.

6. *Cleansing and Extinguishing.*

For cleansing, open the man hole, beat down and make even the top of the mass. During the cleansing from time to time, look at the interior so as to put more coal dust on the planes which are too red.

As soon as the mass of charcoal becomes a dark red and if it no longer smokes, proceed to extinguish.

For this purpose, ascertain that the earth has not run down the chimneys, and if it is about 50 c/m. above the ground; bury completely the air pipes, examine likewise the upper part and then leave the oven alone for 15 to 20 hours, there will be no more fire.

To facilitate the extinction before closing the man-hole, throw on the top of the pile of charcoal three or four handsfull of green or grey litter or anything that will clear the smoke. Finally if water can be procured pour on the head of the cone of charcoal 2 water-cans full.

7. *Emptying the Oven.*

This operation must be done quickly, especially if it is windy for fear of the fire spreading. Lift up the panel door at the top, then the one at the bottom, take out the charcoal by means of a hook; charcoal should be taken first of all from the centre and then from the bottom when half a sackful has been drawn out, place it in a semicircle as far as possible from the door. The embers must be put by themselves.

The charcoal must not be put into sacks until three or four hours after it has been taken out of the oven, the longer the charcoal is left in the air, the firmer it will be and the less apt to break.

In case of fire in the centre which happens if the rotten wood has not been thrown out, or if the fissures have been badly stopped up, throw on the fire some fresh and fine earth and immediately turn out the charcoal.

The emptying of the oven must be fully completed before leaving it.

General Rules.

1. The ground must always be level and rather slightly damp than dry.

2. Wood which is more than 6 to 7 c/m. in diameter must be split and in spite of the outlay which this work necessitates, there is a very great advantage in performing it not only with regard to the quality, but also for the sake of the yielding.

3. The smoke must always be white, except towards the end of the operation when it becomes blue.

4. From the time of laying the fire to the extinction thereof, not more than 30 to 36 hours should elapse.

5. A good lighting and a rapid heating is very essential, it is the secret of the operation.

6. When once the lighting hole and the buses are well closed, avoid any draught going through the mass.

J. W. CHERRY.

Letter No. 1898 dated 25th November 1893, from O. Wolfe Murray, Esqr., Collector of Nilgiris, to the Conservator of Forests, S. C.

With reference to your letter No. 1801 dated 18th August 1893, I have the honor to furnish you with the necessary information.

A copy of the instructions received from the Director-General of Stores, London, is enclosed, which gives a description and plan of the kilns.

2. One kiln was obtained in 1886, at a cost of Rs 627-7-11, delivered at Coonoor, and 2 more arrived in December 1890, at a cost of Rs. 1,345-13-9. These are now in the Ootacamund Range.

3. All three were used for burning charcoal and acacia wood were used.

4. From October 1886, up to the end of March 1893, 1,928,100 lbs of wood were burnt in the Kiln at Coonoor which yielded 309,754 lbs. of Charcoal or 19·06 per cent. The cost of working including the value of the wood, wages or burners, &c., amounted to Rs. 4,020. The interest on the outlay and the cost of supervision has not been added, also repair charges, amounted to Rs. 150. This kiln is now almost worn out.

In the two kilns at Ootacamund 4,389,875 lbs. of wood were burnt from December 1890, up to the end of March 1893. 734,384 lbs. of charcoal were produced-17·7 per cent. The cost of working was Rs. 7,831 and the value of the charcoal Rs. 9,835 the, profit being Rs 2,(04 The bottom portions of these Kilns are worn out and brick protecting walls have had to be erected.

The native system of manufacturing charcoal has not been successful. The out-turn of charcoal to the wood used seldom exceeds 11 per cent and the cost of making the kilns and wages of the burners exceed the value of the charcoal produced.

The Moreau kilns are the best portable kilns extant; but if the sheet iron of which they are made were thicker, they would last longer, as it is, the iron burns out at the base after a few years' work.

Mr. Morgan has invented a charcoal kiln made entirely of bricks which only costs Rs. 70 and produces quite as good an out-turn of charcoal as the Moreau kilns. These brick-made kilns are now largely used for the production of charcoal in the District.

NOTE.—The above papers have been sent to us by the Inspector-General of Forests for publication. We think it right to mention that the introduction of the Moreau Kiln was due to our own arrangements when in charge of a Circle in the Madras Presidency. The successful working of the Coonoor Kiln was primarily due to the pains taken by the then Ranger Mr. Nullasamy Naidu.

HON. ED.

IV.—REVIEWS.

The Protection of Woodlands by Dr. J. Nisbet.

We have received, by the kindness of the translator, a copy of his book "The Protection of Woodlands' a translation from the German work of Dr. Hermann Fürst, Director of the Bavarian Forest Institute at Aschaffenburg, and we have found it very interesting. In his Preface, Mr. Nisbet tells us that after considering whether a short manual on the subject would not be desirable, he came to the conclusion that a translation of Dr. Fürst's work, arranged for the fourth edition of Dr. Kauschiger's 'Lehre vom Waldschutz' would probably be of practical benefit to sylviculturists in England and Scotland, and most particularly in drawing attention to the dangers of *pure* forest, so liable to insect and fungoid diseases.

The *first section* treats of the Protection of Woods against injuries due to inorganic agencies, such as frost, heat, rain, snow, storms, lightning and also from unfavourable soil and situation. All these are carefully treated one by one, their effects upon the principal trees are studied and described, and preventive measures are suggested as well as remedial ones where such are possible. The recommendations seem good and practical but we venture to think that in speaking of the precautions to be taken to prevent the fungoid infection at page 62 there must be some mistake and that with storms coming from the westward it is on that side of the infected area that nurseries should be placed, if the carriage of spores from the forest to them is to be avoided.

The *second section* treats of the Protection of Woods against agencies, such as weeds, parasitic plants, and animals of all kinds especially destructive moths and beetles. This notice, as may be expected, occupies much the largest part of the work and contains a large amount of valuable and useful and interesting information. There are a few plates of the most important of destructive insects, but we should have liked to have seen more figures and to have had these in the pages of the work and not relegated to the end. To those who have not specially studied entomology, good pictures are of the greatest assistance.

The *third section* and last, treats of the protection of Forest boundaries, the protection against misuse of rights, against forest offences, against fire, and against damage from smoke and atmospheric impurities.

The book is well got up, it is published by David Douglas of Edinburgh and is dedicated to our Inspector-General of Forests, Mr. B. Ribbentrop C. I. E The print is very good and though we are scarcely well qualified to judge, the translation seems excellent. Here and there we have noticed phrases which are slightly German in style and some of the words used are rather doubtful, for instance 'cortaceous bark,' which occurs more than once, seems a curious phrase and is not very clear, indeed we doubt if the word is an admissible one for the Latin word is properly 'corticeus.' However, this is a very small matter, and we congratulate Mr. Nisbet upon a successful piece of work that must have occupied a considerable part of the time of his furlough.

Annual Agricultural Report of Bengal for 1892-93.

We see from this Report, lately received, that the question of inducing zemindars in permanently settled estates to adopt measures of forest preservation, has been seriously started, and it is to be regretted that the service of a Forest Officer to assist in the work could not be spared.

The establishment of fuel, fodder and pasture reserves also engages attention, especially in Chittagong and Orissa. From the latter Province the Settlement Officer, Mr. H. Reily writes "in 'the upland laterite treats, where population is sparse and cattle are 'few, forests are being recklessly denuded by indiscriminate cut- 'ting and grazing of cattle, but there is no immediate necessity for 'establishing reserves in those parts." This is somewhat contradictory and not very logical.

Casuarina plantations are being started in the Civil Station of Puri, we presume on coast sands. We shall be interested to hear the result of this; it might almost be worth while to do the thing properly and protect the coast between Puri and the Black Pagoda by a good Casuarina belt like that of the Nellore and Chingleput Districts further South.

Date-palms are reported to be doing well at Hazaribagh, Ranchi and Sasseram, and badly at Patna.

The experiments in the reclamation of 'usar' lands in Behar by means of growing the "*Pithecolobium Saman* and *Albizzia procera* are being continued, though the results, so far, have not established the possession by those trees of any special virtue in reclaiming saline lands. Perhaps the trees are too far apart and too young yet for accurate judgment of results.

Progress Report of Forest Conservancy in Ceylon for 1892

"Forest Conservancy in Ceylon does not appear to progress as smoothly as might be wished and the Report for 1892 by Mr. Broun, who was permanently appointed just before the commencement of the year to the post of Conservator of Forests, indicates that the e is much opposition and many difficulties to be overcome before the forests of that colony can be properly administered. The co-operation and sympathy of the Government Agents are, we doubt not, as necessary for successful Forest Administration in Ceylon as is the case in India, and we trust that succeeding reports will have a more favourable account to give in this respect, at any rate as regards one or two of the provinces in which the relations between the departments appear to leave much to be wished for.

The total area of Reserved Forest at the commencement ot the year was 23,473 acres. The reservation of areas is still going on but the progress during the year is reported to be unsatisfactory, only some 19 square miles having been finally proclaimed during that time, so that the total area at the close of the year stood at 35,503 acres In this matter the Conservator complains that as regards reservations in the Sabaragamuwa Province, he is never consulted, and only receives his information from the Government Gazette.

In the preparation of Working Plans there is not very much to record, though a commencement has been made by Mr. Hansard who has been employed during the year in framing a plan for a portion of the forests along the Nanu-oya extension, which it is proposed to work by compartments in alternate strips running at right angles to the prevailing winds and varying in width according to exposure. Some of the measurements taken in the sample plots may be interesting and are therefore appended.

"*North-Central Province.*—Of three sample plots selected in '1889 and 1891, two have been re-measured, but I fear that the '*data* obtained will not be of very great use, the first sample plot 'consisting, not of one compact block of trees, but of clusters of 'trees selected here and there, and not only of indigenous trees, 'but also of exotics planted at different places about Anurádhapura. 'The record is nevertheless interesting, as the following measure'ments will show :—

'No. of Trees measured.	Species.	Average Girth. 1860. Inches.	Average Girth. 1893. Inches.	Mean Girth. Increment. Inches.	Mean Annual Girth Increment. Inches.
3	Teak	7 87	19 37	11·50	3·83
11	Spathodea	24 00	49·09	25·09	8·36
4	Grevillea	6·75	13·75	7 00	2 33
1	Mora (*Nephelium Longana*)	4 50	9 00	4·50	1·50
32	Satin*	26·75	30·31	3·56	1·15
4	Milla (*Vitex altissima*) ...	10·50	12·50	2·00	0·67
27	Halmilla (*Berrya ammonilla*)	21 50	21·70	3·90	1·07
3	Flamboyant (*Poinciana regia*)	21·66	38·00	6·34	2·11
1	Ranai (*Persia semecarpifolia*	38·75	40·75	2·00	0·67

'The exotics are evidently better growers than the indigenous 'trees, but the slow growth of the latter may be due to the shock 'which they may have experienced owing to their sudden isola'tion.

'The other sample plot, which the Assistant Conservator calls 'the Nuwarawewa plot, is, according to him, an unfortunate selec'tion, as it is irrigable land under the tank, and is bound to be 'sold sooner or latter. An interesting experiment was made here 'in order to ascertain the difference in growth of halmilla in 'cleared and uncleared land :—

'CLEARED PORTION.

No. of Trees measured.	Species.	Average Girth. 1890. Inches.	Average Girth. 1893. Inches.	Mean Girth Increment Inches.	Mean Annual Girth Increment. Inches.
244	Halmilla ...	10 13	12 06	1 93	0·64
3	Ranai ...	24 00	29 00	5·00	1·67
1	Ebony ...	6·50	8·50	2·00	0·67

UNCLEARED PORTION.

No. of Trees measured.	Species.	Average Growth. 1890. Inches.	Average Growth. 1893. Inches.	Mean Girth Increment. Inches.	Mean Annual Girth Increment. Inches.
77	Halmilla ...	9 32	13 24	3 92	1·31
1	Ebony ...	4·00	6·50	2 50	0·83

'Thus, halmilla in the uncleared portion has grown at a quicker 'rate than the trees which have been suddenly exposed to sun and 'wind."

Another sample plot in the Kulugalla Forest shows a mean girth increment of ¼ inch for *Mischodon zeylanicus* and ⅓ inch for *Mimusops hexandra.*

The following extracts under the head of artificial reproduction are given as they contain interesting information regarding the results of planting in Ceylon.

"In the Nuwara Eliya plantations the blue gums planted in '1888 average 17 in. in girth and 40 ft. in height, and the *Cryp'tomeria* of the same age 6·67 in. in girth and 14 ft. in height in

'the Lackchéri clearing, while in the nursery clearing the blue
'gums of 1888 only average 12·04 in. in girth and 28 ft. in height.
'In this clearing the average girth of *Acacia melanoxylon* of the
'same age is 6·25, and the average height 20 ft., while *Acacia*
'*decurrens*, also of the same age, attains an average girth of 23·67
'in. and a height of 40 ft. The *Eucalyptus robusta* planted in 1891
'has not done quite so well as at Nánu-oya, as it averages only
'4·62 in. in girth and 14 ft. in height. These plantations are
'getting on very nicely, but are somewhat expensive, as the area
'added during the year and the upkeep of former plantations cost
'upwards of Rs. 73 per acre. In the North-Western Province
'all the plantations are doing well, except the portion which was
'taken up at Puttalam for teak. The plantation of teak and jak at
'Kumbulpola 10 acres in extent is doing well and has only cost
'Rs. 525 in three years, while that of Sundapola, which is equally
'successful, and which now covers 89 acres, has cost less than
'Rs. 2,000. This plantation is chiefly of teak and jak, but also
'contains other species, such as satin, margosa, and the large-
'leaved mahogany, while the place is full of self-sown seedlings
'of lunumidela (*Melia dubia*) and also of jak, for the forest contains
'a number of wild jak trees. The plants are put in partly
'in well-cleared strips and partly under shelter of the forest,
'which has, however, been considerably thinned. It will however
'be necessary to make further thinnings, as the young plants are
'growing far too lanky and spindly. I think these would benefit
'by being topped."

In the Eastern Province the Teak chenas have not been a success. Most of them consist of sheets of illuk grass with scattered teak poles and the granting of these chenas has been discontinued. The efforts of the Department should in future be directed to the proper stocking of these areas with Teak or other quickly growing trees which can fight successfully with the invading grass.

Small improvement fellings are reported to have been made here and there but without system. The Conservator complains of the want of zeal on the part of his Assistant Conservators in this respect and comments on the fallacious idea which seems to be more or less prevalent that improvement fellings should not be undertaken unless they can be made to pay.

From remarks of this nature occurring in various parts of the Report we are led to suspect that the obstacles in the way of proper forest management in Ceylon are not only those which are met with from without, but that the want of zeal and due understanding of the object and importance of forest works on the part of some of the members of the department are equally or even more obstructive to the progress of Forest Conservancy.

In addition to 2,413 cubic feet of timber chiefly Satin wood and 7½ cwt. of ebony supplied direct from the Central Depôt, 18,800 cubic feet of timber were supplied from the provinces to be sent to the Chicago Exhibition. The amount applied for by the Commissioner in charge of this work appears to have been double the quantity actually required, the value of the royalty of the timber supplied being estimated at Rs. 9,000.

The financial results show a considerable improvement on those of last year the deficit which in 1891 was Rs. 31,170, having been reduced to Rs. 13,178. The outstandings due to the department are, however, very much larger than last year and those due by the department at the close of the year very much less, so that on the whole the results are not unsatisfactory and the improvement is certainly considerable.

Forest Administration in Jodhpur, 1892-93.

In our July number, 1893, we gave an account of the results of forest work in Jodhpur for 1891-92 and were able to record fairly good progress. The present Report seems to indicate some falling off, both financially and in protection. The whole Jodhpur Range 9,240 acres is struck off the list as "transferred to the Shikarkhana Department" which we suppose means that it has been formed into a private shooting preserve. As the Jodhpur Range gave most of the revenue, it is not surprising that the year's financial results shew a deficit.

Fire protection was fairly successful as only 940 acres out of 181,760 were burnt. Natural reproduction is reported as very satisfactory, as is the growth of coppice shoots and seedlings.

The former forest officer Lala Daulat Ram Bhimbhat was transferred to the Punjab and succeeded by Pandit Gokal Dás, a Ranger from the same Province.

Mineral Production in India for 1892.

This is an interesting return with some important statistics. The chief minerals treated are salt, coal, iron and petroleum and the following was the out-turn of each for 1892.

	Tons.		Rs.		
Salt	8,98,909	valued at	5,382,845	chiefly from	Madras and Bombay
Coal	2,537,696	„ „	8,357,052	„ „	Bengal
Iron ores	23,161	„ „	2,63,114	„ „	Central India
	Gallons.				
Petroleum	8,725,331	„ „	3,76,592	„ „	Burma

Among other minerals the chief, of course, is gold, and of this 163,187 oz. valued at 9,896,021 rupees were produced in Mysore with smaller amounts in other provinces and states. Some few minerals are treated as forest produce we see and the chief of these is mica of which Bengal turned out 120 tons valued at Rs. 98,154 the amount and value of the exports of the year having been 166 tons valued at Rs. 4,34,348 !

Soapstone is worked as a forest product in Madras and there is said also to be excellent stone in Upper Burma. Corundum is another article of forest trade in Madras, and antimony mines are leased by the District Forest Officer of Jhelum in the Punjab.

'Mineral Paint' of a 'slatish' colour is found in a vein on the Kishengarh Hill in Rajputana and has been found a good substance for painting wagons, iron-work and ships, and as such has been used by the Rajputana-Malwa Railway.

Indian Railways Report for 1892-93.

As usual, this Report, profusely illustrated by excellent maps, is very interesting and instructive. As regards its bearing on forest work, however, the only part of special interest is the Chapter on Fuel consumption. The statistics for 1892 give

Coal, English	204,603	tons
„ Indian	875,996	„
Coke	9,496	„
Patent fuel	4,139	„
Wood	300,682	„

The North-Western Railway procured its wood fuel partly from the Bahawalpur state forests at Rs. 45 per 1000 cubic feet; partly from the Sind forests at Rs. 34 to Rs. 44 per 1000 cubic feet; partly from the Punjab forests at Rs. 50 to Rs. 57 per 1000 cubic feet.

The Madras Railway obtained its firewood at rates which varied from Rs. 3-6-0 to Rs. 7 per ton.

On the Southern Mahratta Railway, Kánara firewood was used at the rate of Rs. 4-4-0 per ton paid to the Bombay Forest Department; Mysore firewood at Rs. 6-2-8 per ton.

The firewood used on the Burma State Railway cost Rs. 7-2-0 per 100 cubic feet.

We regret to have failed to find any account of the comparative cost and comparative durability of the various kind of sleepers, wood and iron, in use.

VI.—EXTRACTS, NOTES AND QUERIES.

Sal-leaf blight in the Dun.

Last autumn a blight was found on the leaves of the Sál (*Shorea robusta*) trees in the Dún forests by Mr. A. Smythies, Deputy Director of the Forest School. It took the form of sooty black felt-like patches on the leaves and as it was sufficiently common to be probably able to retard growth, specimens were sent to Dr. D. D. Cunningham, C.I.E ,, F.R.S., in Calcutta, who was kind enough to examine it and whose report is as follows :—

"The Sal blight is due to one of the so-called black mildews—a *Perisporiaceous* fungus certainly very close to *Meliola* or *Antennaria*. Its mycelium is purely superficial, so that any damage which it causes must be dependent on the thick crusts interfering with transpiration. It will not be easy to contend with, as it has such abundant and varied means of propagation. The first fructification which appears is a simple conical cone borne on the threads of the thallus. Subsequently *Perithecia* and *Pycnidia* appear in large numbers, long, slender, curved, uniseptate, almost colorless ascospores, and the latter filled with huge deep brown, uniseptate conidia, which, I should imagine, represent resting spores, as they possess characters implying much greater resistance and persistence than the free conidia or ascospores do.

'Beyond burning the fallen leaves covered by the masses of such resting fructification, I do not see what can be done to check the extension of the blight."

It is probably the same, or closely allied to, one which was found in the Oudh forests in 1892 by Pandit Keshavanand, Extra Assistant Conservator of Forests.

Firewood Splitting Machinery for the Colonies and Abroad.

In many parts of the world, where wood is cheap and plentiful and coal scarce and expensive, the former has to take the place of the latter as fuel for manufacturing and general purposes. The preparation of "firewood billets" in such countries must therefore, as a matter of course, constitute a very large and important industry. Anything, consequently, that will tend in these days of keen competition and small profits to cheapen the production of this indispensable article by the aid and means of cheap and effective machinery, will doubtless be received with the consideration it deserves by manufacturers, railway and steamship companies, planters, and others, who find themselves obliged to have this kind of fuel.

From a careful examination made of the annual trade reports of the British Colonies, Consular reports, and from other reliable sources, it is found that firewood is used in enormous quantities in South America, including Brazil, Chili, Paraguay, the Argentine, Venezuela, Peru, Mexico, &c., for railways, river and coasting steamers, cattle ranches, brick and tile works, tanning factories, mines, &c.; in British and further India, including Assam, Burmah, and Ceylon, for railways, river steamers, tea and coffee estates, brick and tile works, rice mills, &c.; in the Far East including the Straits Settlements, Johore, B. N. Borneo, Siam, Saigon, Sumatra, Java, &c, for railways, steamers, sago and tapioca and sugar factories, brick works, rice mills, &c. The following countries also use wood fuel in large quantities: South and East Africa, the Zambesi, West Coast of Africa, the Congo Free State, Senegal, West Indies, &c. As an example it may be mentioned that the Indian railways alone used in 1892, 300,682 tons.

Mr. Fred. Boultbee, of Messrs. A Yates & Co., Luddenden, *via* Manchester, who has had great experience in the East as a saw-mill engineer, has for a long time given this important question much consideration, and the firm in question have, through the experience gained by him abroad, and experiments made, invented, patented, and are now prepared to supply machinery and plant for dealing with any kind or class of wood, no matter how hard, refractory, crossgrained or knotty, and converting the same into "billets" of any required size suitable for fuel.

The methods adopted at present in the East and in fact all over the world, for splitting up "mangrove," and other woods suitable for fuel into "billets," may be briefly described as primitive, costly, and unsatisfactory; heavy, long-pointed axes and wedges being employed to break open the logs and split them up into suitable sized pieces, and with the present means and appliances, it is found impossible to deal with trees of more than 9 in. diameter, and only those, moreover, that are straight grained and free from knots are selected for the purpose; the consequence is that the largest and most matured trees which, of course, make the best fuel, are left and as the coasts, rivers, creeks, swamps, and lakes of all tropical countries are deeply fringed with belts of "ever-spreading prolific Mangrove" (*Rhizophora Mangle*), in most cases several miles deep, containing millions almost countless of trees only fit for fuel, some idea may be formed of the quality left by Messrs. A. Yates & Co.'s machinery.

Given an inexhaustible supply of "mangrove" and other timbers fit for nothing else but fuel, these territories undoubtedly afford a splendid and vast field for the establishment of firewood factories," fitted up with suitable machinery and plant for the rapid and economical conversion of this waste material into "billets".

for fuel, and industries of this nature would form quite a new departure in the annals of woodworking machinery, and must certainly prove a lucrative business to the introducers thereof, besides stimulating and encouraging local industry, as the natives could be employed and would only be too glad to make contracts with the proprietors of the factories to keep them supplied, at a very cheap rate, with mangrove trees, which at present, for the reason given, they are unable to split up by the primitive means they have at their disposal Briefly, "firewood splitting up machinery" would play the same part as the "saw-mill" now does, compared with the days when beams, planks, and scantlings were sawn up by hand.

The machines employed by Messrs A Yates & Co. for this purpose are strong, simple, cheap; require but small power to drive, need no heavy and expensive foundations on which to work, can be worked by unskilled labour, cannot well get out of order, and will deal with every description of timber of any diameter, no matter how hard, refractory, crossgrained, or knotty, and convert the same into "billets" of any required size. The machinery, briefly, consists of a log-splitter, and which can be worked by hand or power. This "breaks down" the log, after it has been cross-cut to any required lengths, into suitable-sized segments; these latter are then dealt with by the "billet machines," which split them up into pieces of any required size ready for use. Thus Messrs, A. Yates & Co's "firewood billet machines," working in connection with one of their "log-breaking-down machines," improved cross-cut saw, and driven by a small vertical or portable engine, constitutes a complete firewood factory. In addition to complete firewood splitting-up installations for turning out any required number of "billets" per day, the firm also supply special plants for fixing up on barges, lighters, and flats, with light draught, for taking up shallow rivers, creeks, &c. (*Timber Trades Journal.*)

Imperial Forest School Dehra.

THE PRIZE DAY.

The annual distribution of certificates and prizes awarded to students during the past year was held at 4 P. M. in the drawing hall of the Forest School, on Saturday, the 31st March last. Some of the best maps and drawings done by the students who were leaving were displayed on the walls, while the pick of the collections of plants and entomological specimens were laid out in the library and museum for the inspection of the visitors. The following Forest Officers were present: The Inspector-General of Forests, Mr. B. Ribbentrop, C. I.E. Messrs. Hill and Oliver, Conservators of Forests; the school staff, consisting of Mr. Gamble, the Director; Mr. Smythies, the Deputy Director; Messrs. Gradon and Rogers, Instructors; Mr. Grenfell, Deputy Conservator of Forests, Saharanpur Division, and Mr. Billson, who has lately joined the Direction from Coopers Hill. Mr. Duthie, Director of the Botanical Department, Northern India, represented the non-resident Professors. The vernacular instructor, Babu U N. Kanjilal, and Pandit Sadanand, a passed student of the school, and now in charge of the Dun Division, were also present.

The Gurkhas were represented by Colonel Begbie and Captain Macintyre: the Forest Department by Mrs. Smythies and Mrs. Gradon: the planters by Mr. and Mrs. Hodges, Messrs. Armstrong and Litchfield. A number of other ladies and gentlemen of the station were also present.

The Director began the proceedings by reading a report on the work of the school: he stated that the year had been an uneventful one, and that he was glad of it, as there was nothing so good for the progress of an educational institution as a few years of quiet work without changes in the teaching staff. He then alluded to the new students' quarters, which were commenced about a year ago, and are now approaching completion, expressing the hope that when ready for occupation they would help to lessen still further the expenses of students, and he stated that if the long deferred sanction, which was expected from England, to the recognisation of the Provincial Service, were received, he expected it would be difficult to provide for the increase in the numbers of students which would as a natural consequence follow.

The number of students who were leaving the school, he said, with certificates, was the largest on record. Sixty-one students, fifty in the upper and eleven in the lower class, had entered the school in July 1892. One of these had to leave through illness, and another, Charles C. Vieyra, had died of consumption while at the school. Vieyra was a great favourite among the students, and he was sure that he expressed the feelings of both staff and students when he said that all regretted the sad incident which had prevented his name appearing among those of the successful students that day. Of the fifty-nine students that had gone through the whole course, fifty-two had been granted certificates, which represented a very good percentage. Three students were granted "honours" certificates, another source for congratulation, as in the two preceding years no student had gained that distinction. The total number of students in the school is 106. Next year he anticipated a small falling off in the number of students: this would be temporary only, and be probably due to the fact that the Home authorities had not yet recognised, as the Government of India had so fully done, the necessity of increasing and improving the executive staff of the department. He then announced the winners of medals and special prizes, all of whom were loudly applauded as their names were read out. There were no medals granted for Forest Engineering and Botany, as no student had done sufficiently well in either of these subjects. Corbett obtained the medal for Sylviculture ; the Inspector-General's prize for the best essay on a sylvicultural subject ; Mr. Smythies' prize for the best in Practical Forestry, and the second prize for notebooks kept on tour. The medals for Utilisation and Working Plans and Forest Law were awarded to Syed Burhan-ud-din. Two students were equal in surveying, namely R. E. Hannah and Gurbuksh Rai, both of whom received medals. The medal for the best herbarium fell to Ram Swarup, and the Director's prize for the second best herbarium to Maung Aung Thu. The medal for Forest Mathematics was given to Panchipikesa Iyer, as was also the Campbell-Walker's prize for the best Madras student in Forestry, and Mr. Moir's prize for the best student in Forestry in the whole school. The Director's prize for the best entomological collection was awarded to J. F. L. Tweedie. The medals awarded to the lower class were given to Durga Dutt and Mahomed Yasin.

The Director then stated that the present class had as much excelled in games and athletics generally as they had in their studies. Langhorne, R. Pocock, Tweedie and Chinniah were conspicuous at the athletic sports, while Tweedie and Corbett were the mainstay of the cricket eleven. Tweedie had twice made over 100 runs, and the Cricket Club were presenting him with a bat in recognition of these achievements. He then referred to the good work done by the Mounted Rifles under the command of Major Leslie Rogers, and regretted that the Commissioner of the Division, Mr. Harington, who also evinced the greatest interest in volunteering and in the school, though in the station yesterday, was unable to stay for the distribution of the certificates.

The Director then referred to the drill of the native students and thanked Colonel Beglie, of the 2nd Gurkhas, the Officer Commanding the Station, for the assistance of his havildars, and other acts which showed his interest in the school. He then acknowledged the services of the school staff and the way in which they had supported him in all school work, and proceeded to congratulate the Deputy Director, Mr. Smythies, on his promotion to the rank of Conservator, to regret his departure from the scene of many years of patient labour, to offer him on behalf of the staff and the students every good wish for success and prosperity in his future career, and then expressed the hope that he might some day return to Dehra as a member of the Board of Control He then proceeded to welcome the new Deputy Director, Dr. Nisbet, who, he informed his audience, had not on y an Indian but a European reputation as a forester of learning and experience, and he was sure that under him the teaching of Forestry would continue to maintain its present position in the school. The Director then expressed his thanks to Messrs. Reynolds and Duthie and Major Bingham for their kind help as examiners, to Messrs. Cotes and

Collins as teachers, and to the staff of the school circle, Messrs. Moir, Hearle, Grenfell and Billson, for their assistance in the class room and on tour. Finally, he expressed his sympathy with the members of the Board of Control, Mr. Ribbentrop, Messrs. Hill, McKee, Oliver and Reynolds, who had all suffered from that most unpleasant enemy influenza, and hoped that they might soon recover their usual good health. Finally, he concluded by saying good-bye to the students, and expressed a hope that the ymight distinguish themselves and never forget their old school.

Mr. Ribbentrop then rose to address the students before distributing the certificates and prizes. He was recovering from an attack of influenza and in a humourous speech begged indulgence from his audience on behalf of himself and the Board of Control, who, he said, ought to be in bed if they were not actually there. He then added that he had intended merely to tender an apology for the Board of Control, but that the encouraging words of the Director, and the favourable report, had given him sufficient confidence to say a few words more. He thanked the audience for the sympathy they had extended to the institution which had grown up in their midst, and trusted that they would give him some "grace-marks" in case he required them at any period of his speech. The Inspector-General continued by informing his audience of the sad condition in which the demon influenza had left the Board of Control, he said that he had no sooner appointed a new man to strengthen the board than he also was attacked by the same disease, but that in spite of their crippled condition they had striven to do their work conscientiously, and had succeeded in doing so. The present year would, he said, be known not only as the year of influenza, but the year of honours. No fewer than three students had achieved that distinction, and he maintained that it was no mere coincidence that the three first men represented the three chief races and religious of the Indian Empire, the Hindu, the Christian and the Muhammedan (applause); that it indicated the direction in which the general educational policy of the Government of India was progressing; that it was a real indication, which he considered a matter of congratulation, especially in these days when unscrupulous persons are trying once more.to fan the dying embers of race antagonism and religious fanaticism into flame. (Renewed applause.) Mr. Ribbentrop then said that it was most satisfactory to note the constantly increasing proficiency in sylviculture and other branches of forestry; he stated that in these subjects the examiners could most easily sift cram from true knowledge, that they had done so carefully, and that the result was most creditable to the school staff and the students. He then added that the greatest credit was due to the teacher of the direct branches of forestry, Mr. Smythies, who had gradually developed his lectures to their present standard of excellency; he continued by saying that Mr. Smythies was leaving Dehra, and humorously called upon the students to give three hearty cheers for Mr. Symthies, the sylviculturist. This was heartily responded to by the students, and when quiet was once more restored, he twitted the students on their vocal powers, and called upon them to give three cheers for Mr. Smythies, the Captain of the Mounted Rifles, assuring the audience that he was one of the mainstays of volunteering in Dehra. He evoked much laughter by alluding to the parade which had been held under the command of Captain Smythies a few days previously. The cheers called for were lustily given, and while they were continued Mr. Ribbentrop sat down, only to rise once more and express the wish that the students who were leaving would work in the Forest as hard and as conscientiously as they had at the school, that they would maintain an *esprit de corps* among themselves and always remember their old school with affection.

The certificates and prizes were then distributed by Mrs. Smythies, at the request of the Inspector-General of Forests. The honour-men: Panchipikesa Iyer, Syed Burhan-ud-din and Corbett were loudly applauded by their fellow-students. After this part of the function was over, a cricket bat was presented by Mrs. Smythies to Tweedie, for the scores of 102, not out, and 100 which he had made against two Mussoorie schools last year. The students then called upon Mr. Smythies for a speech, and he briefly responded by expressing his sorrow at leaving the school, and also the hope that the junior students would pass as brilliant an examination as the present seniors had. He was again called upon as Captain Smythies to make a speech, and said that he wished to say good-bye to his Volunteer comrades, and was sure that the corps would continue to flourish under Major L. Rogers and Lieutenant G. Rogers, who, he hoped, would be elected as Captain in his stead. (Applause.)

The Director then called upon the students to give three cheers for the Board of Control and the ladies; cheers were then given for the school staff and Mrs. Smythies, and with these the proceedings terminated.

An account of the distribution of certificates would be incomplete if no reference were made to the condition of the school museum, herbarium and grounds. The Director has devoted a large portion of his time to the arrangement of the museum and herbarium, and their present excellent condition is due to his personal exertion and ever watchful superintendence. The grounds and park have everywhere evidence of his skill and good taste, while the numerous rare plants and trees which are gradually being introduced will, in a few years, be a living testimony of his work as a lover of nature and his skill as a landscape gardener. The Forest Ranger, Birbal, has always ably carried out Mr. Gamble's instructions, and great credit is due to him also for the well kept condition of the school grounds.—(*Pioneer.*)

VII—TIMBER AND PRODUCE TRADE.

Extract from report on the trade of Bangkok for the year 1891.

Teak.

There had been expectations of large supplies of teak after the rainy season had set in. Some merchants had made heavy engagements on these hopes, and consequently experienced much difficulty in finding cargo for the ships they had chartered. The total export of 1891 amounted to 16,100 tons, in comparison with 38,735 tons in 1890. Local prices ruled high, the average price of squares and planks being from £6 to £7 per ton. Of the amount exported, 5,398 tons were shipped to Europe, 4,741 tons to Hong Kong, 3,770 tons to Bombay, and 1,335 tons to Singapore. All other articles of export show a decided decrease in quantity and value excepting woods other than teak (rose, iron, padoo, ebony and sapan wood), which have increased in value from £22,960 to £32,720, and buffalo hides and cardamums, which have also slightly increased.

Return of principal articles of export from Bangkok during the years 1890-91.

Articles.		1891.		1890.	
		Quantity.	Value.	Quantity.	Value.
			Rs.		Rs.
Teak ...	Tons.	16,100	75,207	38,735	2,00,178
Woods other than teak ...	"	7,100	32,720	4,238	22,960
Cardamums ...	"	224	15,834	155	14,228

Extract from a Report for the year 1891 on the trade of Chiengmai in Siam.

Bad season for teak.

Teak merchants say that the past season was the worst for their work since 1885.

British share.

An important feature in the two most valuable branches of trade, *viz.* cotton manufactures and teak, is the increased share taken in them by British firms and their Agents, who are gradually excluding native and other traders, as far as the business with Bangkok is concerned. The Maulmain trade still remains in the hands of Asiatics.

Exports, Teak.

The number of logs of teak which arrived at Chainat (the duty station on the Mënam) during 1890 was, roughly speaking, 9,500, of which about 7,000 came from the Më Ping (Chiengmai River), 1,501 from the Më Wang (Lakhon River), and 1,000 from the Më Yom (Phrë River).

Deliveries at Chainat for the last four years.

The following is an approximate estimate of the arrivals of logs from this district at Chainat for the last four years :—

	Logs.
1888	63,000
1889	60,000
1890	30,000
1891	9,500

1891 delivery.

The delivery of last year was, therefore, about 41,500 logs below the average for the preceding three years. This was due to the deficient rainfall in 1890 being followed by a still more scanty one in 1891. Had the season been favorable, the delivery would have been up to the average, and it is expected that with ordinary good waters the delivery in the coming season from the Më Ling and the Më Wang alone will be 30,000 logs, and with high floods 50,000 logs.

Delivery expected.

Output from Salween forests.

To estimate fully the export of teak from the district, the output from the Chiengmai forests on the Salween must be added to the arrivals at Chainat. The number of logs from Chiengmai which arrived at the Maulmain duty station in 1891 was 43,873 logs being 18,244 logs less than in 1890.

Small logs.

Only small logs appear to be floated down to the Nau River at present, but the forests drained by this river are not very extensively worked as yet. I do not think the rapids are impossible for large logs, but the Nau people, who work their forests themselves as a rule, are said to have some superstition against felling the large teak trees.

Indiscriminate working.

The effect of the indiscriminate working and absence of conservancy is beginning to be very evident in the teak forests of Chiengmai and Lakhon. Teak saplings are cut down in large numbers for house posts and even for making fences, and the clause in the leases forbidding the felling of small trees is disregarded. The consequence is that in Chengmai there is reason to fear that in five years' time the only teak left will be that which is too far from the water to be profitably worked, and in Lakhon the foresters complain that all the best trees have already been felled.

Teak becoming scarce in Chiengmai and Lakhon.

Teak in the Më Kong Valley.

The general opinion of teak merchants and foresters here appears to be that there are large quantities of teak in the valley of the Më Kong and that it could be floated down that river to Saigon, but none has yet reached that part as far as I am aware.

Timber thieves.

The merchants who work teak in the Më Yom complain very much of the timber stealing which goes on at Sawankalók, the rafting station on that river. The stolen logs are often fired with kerosene to deface the hammer marks of the owners. The authorities do not appear to do much to keep the thieves in check.

System of granting forest leases.

The present system of granting forest leases for three years only is very prejudicial to the interests of forests. In many cases the leases are renewed when they expire, but a forester who is not fortunate enough to secure a renewal of his lease may find that at the end of three years, his logs are still lying in the forest, as it takes at least three years, generally much longer, from the time a teak tree is girdled, to fell the tree, lop off the branches, and drag and float the log out of the forest, and if the wording of the lease is strictly adhered to, all logs lying in the forest and girdled trees become the property of the owner of the forest as soon as the lease expires.

Under these circumstances, a forester taking up a new lease, is not likely to girdle many fresh trees, but will only fell the trees already girdled, and the lease being granted for such a short period, he is not encouraged to make a large outlay of capital and labour in the first.

Previous to the year 1888 the leases granted to British subjects were generally for a term of six years, but in that year the time was reduced to three years. This change was due, I think, to the action of the Siamese Commissioner, by whom forest leases are ratified.

British capital.

The greater part of the capital with which the teak trade of the district is carried on is British, and there are now three British firms engaged in the trade which have branches in Chiengmai or Lakhon ; the

Bombay-Burma Trading Corporation having established a branch at Lakhon in 1891. The Chiengmai forests on the Salween side are worked almost entirely with British Indian capital brought from Maulmain.

Squared logs to be sent to Bangkok.

Some squared logs of teak are this year to be sent from Chiengmai to Bangkok as an experiment. The logs are roughly squared in the forest before being put into the river, the advantages of sending such squared logs being that there is less weight to be dragged to water, payment of duty on the valueless part of the log is avoided and the logs obtained are all sound.

Axes used.

The axes used for felling teak have an iron head measuring 10 inches by 2 inches. The axe heads were, until recently, all of native manufacture, but now some of them are imported from England.

Bamboo seed is eagerly sought for and is sold at a high price, sometimes two-thirds the price of rice.

Return of principal articles of export from Chiengmai to Maulmain during the years 1890 and 91.

Articles.		1891.	1890.
		Quantity.	Quantity.
Teak ...	Logs.	43,873	62,117

Churchill and Sim's Circular,

March 5th, 1894.

East India Teak.—The deliveries since the beginning of the year have amounted to 2,534 loads against 1,401 loads for the first two months of 1893. For February alone this year they have been as much as 2,109 loads against only 773 loads in February, 1893. Prices for Wood in the Docks have been firm, with an upward tendency. Floating cargoes near at hand have been difficult to place to advantage, but rather better rates are obtainable for cargoes to come in a little later on. The requirements of British and Foreign Governments will absorb so large a proportion of the shipments, that any improvement in the general demand, which, however, is so far quite invisible, would reveal a scarcity.

ROSEWOOD.—Unsold stocks are light but demand dull.

SATINWOOD.—*Logs*, if figuary and of good sizes, sell well, but for plain wood there is very little enquiry.

EBONY.—There is more enquiry, and prices have a better tendency.

PRICE CURRENT.

Indian Teak	per load	£9-10s.	to	£16-0
Satinwood	per superfical ft.	£0-6d	to	£0-12 d.
Rosewood	„ ton	£5.	to	£8
Ebony	„	£6.	to	£8

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, February 1894.*)

Cardamoms,	per ℔.	2s.	to	2s.6d.
Croton seeds	per cwt.	20s.	to	27s.6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	40s.	to	52s.6d.
Gum Kino	„	£15	to	£18.
India Rubber, Assam	per ℔.	1s.7d.	to	2s.3d.
„ Burma	„	1s.7d.	to	1s.11d.
Myrabolams, Bombay	per cwt	8s.6d.	to	10s.6d.
„	„	4s.	to	4s.9d.
„ Godavari	„	6s.6d.	to	7s.
Nux Vomica, good	„	6s.	to	8s.
Orchella, Ceylon	„	12s.	to	28s.
Redwood	per ton	£3.	to	£3-10s.
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	to	£30

Cawnpore Price Current.

March 29th, 1894.

	Rs.	A.	P.		Rs.	A.	P.
	Per Maund.						
Aonla fruits, dried	0	12	0	to	0	12	6
„ leaves, dried bruised ...	1	12	0	to	2	0	0
Babul Bark	0	7	0	to	0	8	0
Bahera	1	12	0	to	1	14	0
Lac, Stick	24	0	0	to	25	0	0
Myrabolams	3	0	0	to	3	8	0
Moonj Grass	0	8	0	to	0	9	0
Gum, Babul	13	0	0	to	13	8	0
„ Mixed	9	0	0	to	10	0	0

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA

15th February, 1994.—No. 199-F.—With reference to the Notification of this Department, No. 2,81F., dated the 20th December last—Colonel Campbell relieved Mr. Hill of charge of the Central Forest Circle, North-Western Provinces and Oudh, on the afternoon of 18th December 1893, andcontinued in charge of that Circle till the afternoon of 9th January, 1894, when he was relieved by Mr. Wild.

Mr. Hill assumed charge of the office of Inspector General of Forests on the afternoon of 21st December, 1893, when Mr. Ribbentrop went on privilege leave.

Colonel Campbell officiated as Conservator of Forests of the 3rd grade from 19th December, 1893, to 9th January 1894, both dates inclusive.

28th February, 1894.—No.294-.F—Furlough for eight months under Article 340(*b*) of the Civil Service Regulations, is granted to Mr. J. W. Oliver, Conservator of Forests. 2nd grade, Eastern Circle, Upper Burma, with effect from 29th March, 1894, or the subsequent date on which he may be permitted to avail himself of it.

18th March, 1894.—No. 309—Mr. E. P. Dansey. Conservator of Forests, 2nd grade, Bengal, availed himself, on the afternoon of 22nd February, 1894, of the furlough granted him in the Notification of this Department, No. 1059 F., dated the 12th October last.

Mr. A. E. Wild, Conservator, 3rd (Officiating 2nd) grade, is appointed Conservator of the Bengal Forest Circle, during Mr. Dansey's absence, or until further orders, and will assume charge of that Circle on being relieved of the charge of the Central Forest Circle of the North Western Provinces and Oudh.

Mr. R. H. E. Thompson, Conservator, 3rd grade, Northern Circle, Central Provinces, is appointed to officiate in the 2nd grade, *vice* Mr. Dansey, with effect from 23rd February, 1894, and until further orders.

Mr. H. H. Davis, Deputy Conservator, 1st grade, Bengal, is appointed to officiate as Conservator, 3rd grade, in charge of the Bengal Forest Circle, with effect from 23rd February, 1894, and until relieved by Mr. Wild.

2.—MADRAS GAZETTE.

8th March, 1894.—No. 118.—Messrs. C. G. Douglas and E. D. M. Hooper, Deputy Conservators of Forests, Madras, have been permitted by the Right Honorable the Secretary of State for India to return to duty within the period of their leave.

ERRATA.

No. 2. February, 1884.

Page 38, line 8, *for* '1895' *read* '1865'
,, 39, ,, 24, ,, 'Dr. J.' ,, 'Dr. H.'
,, 40, ,, 25, ,, 'representation of some' *read* 'representative.'
,, 40, ,, 28, ,, 'resourse' *read* 'resource'
,, 42, ,, 12, ,, 'production' ,, 'productiveness'
,, 46, ,, 11 from below, *for* '3-10ths' *read* '3-5ths'
,, 47, ,, 11 from below; page 47, line 16; and last line; *for* 'Laupach' *read* 'Laufach.'
,, 48, ,, 36, *for* 'H' *read* 'H^5.'
,, 50, ,, 13, ,, 'Förstlich' *read* 'Forstliche'
,, 50, ,, 4, ,, 'Lenbach' ,, 'Jenbach'
,, 51, ,, 13, ,, 'pines' ,, 'pine'
,, 51, ,, 22, ,, 'commend' ,, 'command'
,, 53, ,, 21, ,, 'representation' *read* 'representations'
,, 60, ,, 7 from below, *for* '6 in. by 7 in.' *read* '6 in. by 3 in.'

No. 3. March, 1894.

Page 86, line 17, *for* '£2,000' *read* '£1,000'
,, 96, ,, 19, ,, 'I' ,, 'we'
,, 108, ,, 7 from below, *for* 'these' *read* 'those'
,, 124, ,, 7, *for* 'Bnrma' *read* 'Burma' and *for* 'te' *read* 'to.'

We regret the lateness of issue of this No., due to our absence in camp at a distance from Head-quarters.

Hon. Ed.

THE
INDIAN FORESTER.

Vol. XX.] May, 1894. [No. 5

Alluvion and Diluvion.

In the *Indian Forester* for February 1894, a correspondent (G. E. M.) on the subject of "Protected Forests," (p. 59) asked a question about the *Rule of alluvial additions* to *Forest estates*, which I will endeavour to answer, as he requests. I have not heard yet of any attempt to replace the old Bengal Regulation XI of 1825, which is still the General Law on the subject.

ON ALLUVION.—The defect of this Regulation is, that it allows its own rules as to ownership to be over-ridden in all cases where there is any other rule of *local custom*. Now, in a country, like the Panjáb or Sindh, where there are many rivers, or at any rate a great deal of river action going on, there are pretty sure to be *customs*, and these customs are usually very various and quite unsuited to modern requirements, such as the local customary rule that the 'deep stream' was always the boundary, and that a man lost his land if the river changed. Clearly this was due to old days of feuds and wars, when the owners were kept from each other's throats only by an unfordable stream between them! And the customs were, in fact, invented in old days, when, owing to the hostility of tribes, villages and petty States or kingdoms, special arrangements were needed, in case a village separated at one time from its neighbour by a stream should become united to it by that stream changing course. But I cannot go into the whole subject of alluvial law, and will come at once to the particular point in question.

The action of rivers coming down from the hills on to comparatively soft and nearly level alluvial plains is not difficult to understand. They have no real bed, for at least a part of their course: as they rise with the melting of mountain-snows, or the 'monsoon' rains, they spread abroad and again decrease, splitting up into a number of branches in so doing, because the tendency of the main stream, laden with alluvial mud, is always to pile up the central bed to a slightly higher level than the rest. This level being overtopped in a high flood, the water must flow away on this side and on that as the obstacles of nature and the lines of least resistance suggest. Practically, two chief results are found to affect riverain property. In the one case (1) small and gentle accretions of soil are found to form up in front ('mahâz' is the native term) of the existing front; or the reverse action may take place, and little by little the area is cut away. Or, (2) a more marked change may take place, which the old Roman writers fancifully called 'avulsion': here the land itself remains, (except so far as its surface may be swept over and injured); what happens is that the stream which before flowed in *front* of an estate now flows *behind* it, or on some other side; and hence what was once a river bed, becomes (in time) dry land, and two estates formerly separated are now close neighbours; and here probably the deserted bed will be divided between them. Of course it is not possible that an area on one side of a river should really be torn off, and float houses, trees and all over to the other side, though this is implied by the word 'avulsion,' it is the river course that changes, not the land.

Of course it is not always easy to tell what is going on. For a stream may really be changing its course, and yet do so little by little that the changes appear to be cases of accretion and diminution, and each flood-season takes the water a little further; with the effect that the—(A) Estate on one bank seems to be (at the moment) only gaining a little by accretion, and the opposite estate (B) losing a little: but in time, the whole of B is gone; and if the river continues retreating, A has now become increased by the entire area, which was once B, or at least by so much of it as is not still occupied by the new course of the shifting river. It is in a case of this sort that the question noted by your correspondent arises. It has also frequently occurred, in cases when the *general* direction of the river has not suddenly altered, but still there is a slight tendency to move one way or the other locally. In such a case there may be two villages X and Y; at present Y is the riparian (or riverain) village and X is just behind it (inland), and therefore has no river frontage; but as the river slowly changes, Y is gradually eaten away, and in time X *becomes* the riparian. After a time a reverse action sets in, and the water slowly retires from X, or in other words new soil appears on the river front little by little.

Now the ordinary and well-known rule of law is that an accretion or "accessory" follows the same right of property as the principal. If a tree is mine, so (in the absence of express arrangements otherwise) is the fruit; and so will a cow and its calf. On exactly the same principle, a gradual accretion of mud, which in time hardens on to my frontier and increases my area is in general an 'accessory.' It seems to come out of the river bed; and actually the estate opposite (on the other side) may not be suffering diminution, for the corresponding loss may be going on somewhere else and in several places. The object of the procedure for constituting a State (Reserved) or Protected Forest, is not, of course, to *create* proprietary right in the Government where it did not exist before (I mean in general ; for part of the procedure may be to obviate inconvenience by buying out little plots of private land and so acquiring the whole, and creating a proprietary right, but I refer to the effect on the area as a whole), but to define its limits, to dispose of claims to easements and other rights which might, if unknown and unprovided for, render management impossible, and above all to announce that special protective rules of law will take effect within those limits which do not apply outside them. Consequently, the *gradual* increments on the river side, where in the nature of things there is no human neighbour, would hardly call for any fresh notification. Whenever an increment belongs to any tenure, all the incidents of the principal tenure attach to it (see Indian Law Reports, Calcutta Series, Vol. VII. 479.) The increment is clearly the property of the State, because the principal thing is. If, however, there were to be a permanent and large increase, it *might* be perhaps found best to *notify* it as Forest, because, though the *river* front or boundary would present no difficulty, neighbours on the other side might encroach, or begin to drive cattle to graze, or to cut 'tamarisk' on the new ground, and it would be desirable to declare it unmistakeably *under* the Forest Law ; and as no rights could possibly exist, the procedure under Chapter II would be merely formal. But here comes the second part of the question. It is perfectly true that any gradual increment, large or small, to a riparian estate belongs to the estate : *but*, the case put by your correspondent, or illustrated by my villages X and Y (above) is different, for though truly X, formerly inland, has now *become*—though perhaps for forty years past—the riparian estate, still, it is known (and I assume *provable* by old maps, records, evidence, &c.) that Y *once* was there ; so that the river lapping on X's shore and adding some strips of ground every season, is not merely *the river* : it is *water over Y's submerged village*—the *basis* of which is still in the depth below. Consequently, when land reappears on X's frontier, it is not a mere accretion to X, it is the *reappearance of Y*, and belongs to the owner of Y.

And this rule has been formally laid down by the Privy Council in the leading case of "*Lopez* versus *Modun-Thakoor*," reported in Moore's Indian Appeals.* It is the leading case

---

NOTE.—It will also be found reprinted in *Bengal Law Reports*, Vol. V, Privy Council Cases, page 521. Rattigan's (Punjab) Digest of Civil Law Chap. XIII gives a convenient *résumé* of the Alluvion Law, a great deal of which is not merely Punjab Law, but general, *e.g.*, the rule of right to *islands* not attached to either shore, and is equally good Law elsewhere.

well known to lawyers. There is a similar case in 4 Moore's Ind. Appeals, 403.

In the case put, it is not necessary to discuss whether the doctrine is applicable in India that a man's property goes "down to the centre of the earth," because in some cases it is does not, at least in the sense that mineral rights may belong to Government; but apart from that, there is no doubt that the *submersion* of any *known estate* by a river does not alter the ownership. In the case above alluded to, their Lordships said: "The site is the property; 'and the law knows no difference between a site covered by water 'and a site covered by crops, provided the ownership of the site 'be ascertained."

There is, therefore, no warrant for saying that in in the case of a *known* or *provable* forest area, disappearing under river flow, and afterwards re-emerging (in proximity to the village estate, once immediately behind it, inland) that "according to existing Rules the forest is gone for ever." No such rule is known to the law. Of course, the Government's right to the Forest area on its reappearing (or any other area) might be *again* lost, under the law of Limitation, by the owner omitting to claim it for twelve years after its reappearance, but that is quite another matter: and in the case of a Government estate, the loss would not occur till *sixty* years had elapsed instead of *twelve*, without any claim to the restored acres.

The *law* is quite clear: but the practice may be different. Take the case of your corespondent's paper. In *principle*, no Court could hold that the Government was not entitled to the new found land: but suppose the *boundary* between the village and the Forest (where both were still unaltered) had never been properly defined or laid down, and there was some doubt about the real total area of the village estate, etc., it might be practically difficult to prove that the new land *was* on the site of the forest. A suit would certainly lie to recover the forest alluded to: it must be successful if the facts can be proved. In short, the rule of accretion may be stated thus:—

When the gradual accretion is really out of the river bed, it forms part of the estate to which it becomes attached, on the principle that the 'accessory follows the principal'; and as regards all rights and incidents of tenure. But when the accretion is not merely out of the river bed, but by way of recovery of a washed away property now slowly coming back again, the new land is (on proofs of the facts) not an accretion to the neighbouring estate, but (as decided in "*Lopez* versus *Muddun Thakoor*") belongs to the original owner.

B. H. B.-P.

OXFORD, *March, 1894.*

Utilization of the less valuable Trees.

Having read with much pleasure Sir D. Brandis' most interesting paper on the above subject in the February Number, I think a few words from me on the Madras aspect of the matter may not be out of place.

I am entirely in accord with Sir Dietrich. The importance of the subject impressed itself upon me strongly during the latter part of my service, presenting itself in every case in which protection became a reality. Its solution is by no means easy. It increases the more in difficulty when protection and the consequent growth are easy, complete and satisfactory. Unfavourable conditions of growth naturally reduce the problem to a minimum.

I am also convinced, like Sir Dietrich, that the solution of this and similar forest problems must be devised by Forest Officers themselves; and that they must not wait for orders of Government or any "higher authority," but work them out for themselves, initiating and fostering industries and sources of demand according to local circumstances.

Too much pains cannot, I think, be taken to impress this especially on the younger forest officers, who are naturally inclined to trust to Providence or the natural laws of supply and demand, and await instructions, instead of foreseeing and grappling with such questions themselves.

The influence of a professional journal like the *Forester*, and of such able papers as Sir Dietrich's, by attracting and directing the attention of Forest Officers to the consideration of such matters, ought to be productive of the best results. I should like to see a great many more such papers and suggestions from retired Forest Officers who have experience and leisure. Even if found Utopian or impossible for immediate adoption, such suggestions should lead to reflection and discussion, and might possibly be ultimately productive of beneficial results.

Turning to Sir Dietrich's suggestions for this utilization of the less valuable trees which embrace wood pavement, impregnated sleepers and telegraph poles, paper pulp, acetates, naptha, wood tar, charcoal, and iron; I am afraid that wood, however well impregnated, which must always be more or less a complicated and costly process, is never likely again to take the place of iron in a tropical country for railway sleepers and telegraph poles, and that the manufacture of acetates, naptha and tar is a little beyond the sphere of practical forestry in India at present, though doubtless deserving of attention at the hands of Forest Officers.

There remain charcoal and iron. As to charcoal, a good deal had been done and much remained to be done, when I left the Madras Presidency, in the direction of improving the process and quality, and rendering larger supplies of a superior article available at reduced prices.

In several instances, the results were excellent, and enabled us to transport and dispose of wood which would otherwise have rotted in the Forest. But it must be borne in mind that the really superior, soft woods produce inferior charcoal—a fact of which our native friends are fully aware—and I am bound to say that good prices were only realised when the charcoal was made from the hard woods or bamboo. Still, as I have said above, a great deal can and should be done in this direction ; and I trust the day has passed in which a District Forest Officer, a German trained one too, with several years' experience, assured me that no charcoal was consumed in his District, a large one, merely because the seignorage returns under that head under the permit system were—*nil !* (*N. B.*—This is a fact !)

There is a very large and steady demand for wood charcoal in the Southern Districts, and, I believe, throughout the Madras Presidency ; and the sooner the wasteful, dangerous and, from every point of view, suicidal custom of granting permits to burn it within wide and indefinite areas on a low rate of seignorage is put a stop to and replaced by departmental operations under a proper system and supervision, the better for the forests, the revenue and the consumers.

As regards Iron—I have never been in accord with Sir Dietrich that the failure of the attempt at its manufacture under European process in the South Arcot and Malabar districts was due to scarcity, or high prices, of wood. I stated my reasons for disagreement in a memorandum on his valuable suggestions of 1883.

They were, and are, briefly, that ample supplies of wood of good quality were available, and granted in most cases free of all seignorage or royalty and in others at nominal rates, greatly to the detriment of the forests ; that at Porto Novo and Beypore the cheapest of all carriage, *viz.*, water, was available, whilst at Tiruvanamalai the forest surrounded the town and was intersected by good roads.

I found the cause of failure to be the impossibility of producing iron with wood fuel in quantity and quality to compete with that produced with coal and imported, and quoted my authorities. In the interest of the Department and of the utilization of the less valuable trees, I regret my conclusions, but must reluctantly adhere to them. With regard to the manufacture of iron by the native process, with gradual improvements the case is somewhat different, and I hope it is not too late for efforts in that direction to produce good results. I do not ascribe the decrease in the native iron industry in Madras to actual scarcity of wood or the rates charged for it and charcoal, which have rarely exceeded a seignorage of a few pie per head load if taken for sale, that for agricultural implements, or own use, being nominally at all events free. But there were, doubtless, restrictions and exactions on the part of the Forest subordinates, and we (myself amongst the number) certainly regarded the iron smelters in past years as enemies and forest depredators, and did our best to suppress instead of encouraging their efforts under regulation. In addition to this, European iron, shaped almost ready for use, found its way into the markets at low prices, and was readily adopted. It was more brittle and less durable than the well-wrought iron produced by the native process, but it was cheaper, and could be procured without so much delay and trouble, at least in the Districts near the coast and on the lines of railway.

In more inland districts, the industry doubtless still survives, and certainly appeared to be flourishing in Bellary when Sir Dietrich visited that District with me in 1882. Whilst, therefore, not so sanguine as he is as to iron-making with charcoal offering "the most promising field for utilizing the surplus wood," I think it most desirable that efforts should be made to revive and foster the old native iron industry with improved appliances and necessary safeguards against waste and destruction of the forest growth.

I am, however, inclined to think that in the supply of wood fuel to the railways, factories, brick kilns, and sugar mills, we shall find a larger and more assured outlet for the less valuable and surplus wood than in the iron and other industries referred to by Sir Dietrich.

It has been customary in Madras for civil officers and others, taking a superficial view of the question, to decry the supply of firewood to the railways, which, it is urged, is denuding the country, for the sake of a temporary revenue, to the detriment of the climate and agriculture.

Under the old system of contractors, who felled as and where they liked, and in the absence of proper protection and regulation, there was doubtless much truth in this view, but with proper departmental action, under which the fellings are regulated and efficient protection subsequently ensured, the objections cease to have weight, and the railways burning wood should become the best friends of the forests and agriculturists, enabling us to conserve large areas for the growth of timber, whilst disposing of the small and inferior descriptions as firewood at prices which will more than cover the cost of conservancy and improvement. It cannot be too frequently repeated and borne in mind that, whilst the denudation of forest areas, however extensive, is, *in the absence of protection*, a mere question of time, comparatively small areas, *properly treated and protected*, will last and give a sustained and increasing field *for ever*. Every Forest Officer is, of course, conversant with this; but we do not always apply it practically, and are apt to grasp at the partial control of large areas instead of restricting and concentrating our attention on such as, with the means at our command, we can really protect and improve.

I well remember Sir Dietrich (then Mr.) Brandis impressing this on me in England years ago with regard to this Salem District, and urging that reform and progress in Forest management in Madras, which was at the time languishing, must be brought about by individual efforts of Forest Officers who understood their profession producing examples of its application on however limited a scale.

I am afraid I did not take his advice so much to heart as I ought, but its truth was brought home to me when a young District Forest Officer, Mr. Porter, concentrated his attention for a time on what is known as the little Sholakarai Reserve in South Coimbatore, and in a short space of time transformed what had been a constant source of expenditure without any good results, into one of permanant income together with an improvement in the growth sufficient to convince the most sceptical of the advantages of rigid protection from fire and grazing and of properly regulated fellings.

Mr. Brasier in Tinnevelly and Mr. Marshall in North Arcot followed suit, and I am glad to see from extracts from Inspection Reports by Mr. Popert in the February number, that the former officer is initiating similar reforms in Salem.

This brings me to Sir Dietrich's remarks on the measure of protection afforded in that and other Districts of the Madras Presidency since his visit, and the passing of the Forest Act.

I regret to have to confirm the conclusions at which he has arrived from a perusal of the Annual Reports, that protection has been most inadequate and disappointing, and *therefore* we do not find the bulk, or indeed any given proportion of the so-called Reserved Forests, forming "dense compact masses of forest growth" as they ought to have done, and certainly would have done in greater or less degree had complete protection been secured and maintained even over comparatively small areas during the past ten years. My last inspections three years ago convinced me that in most of the Southern Districts at least, there was virtually no protection at all; and in Salem and South Arcot the protection was even less than was the case 10 or 2) years before when the enclosed areas then styled "Fuel Reserves" were at least partially protected.

This lamentable state of things was doubtless partially due to the time of the District and Range Officers being much occupied with Forest settlement and demarcation, which have presented many more difficulties and delays than originally contemplated, to the paucity of protective establishments, to changes of District Forest Officers and Collectors, to divergences of opinion, to a vacillating policy on the part of the Board of Revenue (the "Controlling Authority") and of Government; and last, but by no means least, to want of knowledge and zeal, and loss of interest in their work on the part of some, at least, of the District and Range Officers, and to the absence of one professional Head of Department with power to prescribe and enforce continuity of action, encourage the willing, and spur the lazy or supine.

I do not wish to trench on controversial topics connected with the organization and administration of the Department in Madras. Suffice it that, in my humble opinion, there are too many masters, too much centralization in a non-professional Board, and too much non-professional interference all round which irritates and disgusts a sensitive and zealons Forest officer who knows how things should be managed, and affords a screen to the thick-skinned, lazy and ignorant who are fortunately in the minority, in the controlling grades, at all events.

I trust things have mended, and may continue to mend, although my recent advices from Madras are not encouraging.

Anyhow, I would strongly commend Sir Dietrich's advice and hints to Forest officers in Madras and elsewhere.

Reading between the lines they amount to much the same as he gave me years ago. Stick to your professional work, protect and improve 100 acres if you are not allowed to close 1,000, don't write or argue, accept and obey orders cheerfully, but *with discretion* (!) ; trusting to the whirligig of time to bring things straight and the results of your work to speak for themselves, and prove your best reward, and never cease in your endeavours to secure and maintain the highest possible yield of the description of forest produce you wish or are ordered to grow, and to ascertain and develop the best markets for it

If our District and Range Officers adhere to something like the above principles, and the Conservators support and encourage them, and do their best to secure continuity of action and a steady policy on the part of the Board of Revenue and the Government, I do not despair of the adequate protection of sufficient areas being secured, even under the present somewhat complex system of administration in Madras, to an extent which will render the question of the utilization of the less valuable trees urgent. More especially am I convinced that protection alone will not suffice to regenerate the "jungles" in which the trees have been hacked about and browsed over, but that it must be accompanied by "improvement fellings" varying in accordance with circumstances, but all yielding considerable quantities of wood chiefly inferior both as regards description and growth, on the profitable utilization or disposal of which progress will, from financial reasons, greatly depend.

It may not be out of place to state, in conclusion, that the yield of the Blue gum plantations on the Nilgiris has, as Mr. Gamble is aware, exceeded Sir Dietrich's estimates, being nearer 10 tons per acre per annum than 6, but they have not been extended, as there is not sufficient demand even for the annual *coupes*, owing to the existence of extensive private plantations of the same tree. The Nilgiri railway must now be approaching completion, but I do not anticipate much increase in demand from it, either as a consumer or carrier, the rapid growth and large proportion of water in the

Eucalyptus wood rendering it unsuitable for engine fuel, and the cost of carriage to the plains by rail being, I fear, prohibitive.

The yield from the Casuarina plantations in the plains has also proved fully up to Sir Dietrich's estimates, but they have sustained much damage from irrational treatment in order to secure an immediate revenue, storms, and exceptionally dry seasons.

In the case of the Casuarina, the demand is secured, but private enterprise has rendered it almost, if not altogether, unnecessary for Government to extend its planting operations On the whole, I am of opinion that the efforts of the Department are best directed to the conservancy and improvement of the natural forests and "jungles" in order to produce and secure a sustained yield of timber and firewood sufficient not only for present but for future requirements, as well as adequate supplies of grazing fodder and thatching grass, leaves for manure, and other minor produce.

Notwithstanding this somewhat lengthy paper, I feel that I have by no means exhausted the subject, but if my writing leads to consideration and discussion, it will, I think, not be wasted.

NAVAL AND MILITARY CLUB, } I. CAMPBELL-WALKER.
30th March 1894. }

Damage done to Himalayan pines by Loranthaceous parasites.

During his travels in Kashmir in the last few years, Mr. J. F. Duthie, Director of the Botanical Department, Northern India, found again a minute parasitic plant, which he had originally discovered in Kumaon in 1884, and which Mr. J. L. Lace afterwards collected in Kunawar This plant, the *Arceuthobium minutissimum*, was growing on the stems of the Blue Pine (*Pinus excelsa*), and doing them considerable damage. It is probably the smallest flowering plant known, and has the appearance on the bark rather of a moss than of the plants of the family to which it belongs, that of the *Loranthaceæ*, of which the mistletoe is the best known member. Recent enquiries made in the Forest Department by the Inspector-General of Forests brought out the opinions that the mistletoes were certainly uncommon plants on the Himalayan pines, but it is probable that the writers did not quite sufficiently realize that it was the minute *Arceuthobium* that had led to the enquiries and not the comparatively large species of *Viscum* and *Loranthus*. We recommend such of our readers as have the opportunity, to look for the *Arceuthobium* on Blue Pine trees, and ascertain in what the damage it does consists. Those, too, who have the opportunity, whether in the hills or in the plains, should investigate the common species of *Loranthus* and *Viscum*, for it is undoubted that they do considerable damage in some places, and enquiry might lead to means of protection

Albizzia Lophantha as a 'reboisement' plant.

We have received enquiries, asking us, for the information of Baron von Mueller of Melbourne, what it is that is being done with the large quantities of seed of *Albizzia lophantha*, which have been collected every year in Australia and sent to the Punjab for Forest Department purposes. All we have been able to ascertain is that it has been tried in the re-stocking of barren hill sides at 2,000 to 3,000 feet elevation in the Jhelum Salt Range and the Pabbi Hills, where the summer and winter extremes of vegetation may be taken as 170° in the sun and 115° in the shade on the one hand, and 32° and 40° on the other. What has been the result is what Baron von Mueller wishes to know; and we confess also to some curiosity ourselves. Will some Forest Officer in the Punjab kindly tell us all about it—how the plantations were made, whether by direct sowings or by nursery transplants—what has been the result—why was the *Albizzia lophantha* (which by the way is not a timber tree at all) chosen—and what are its peculiarities which render it useful as a 'reboisement' plant?

We have seen the plant frequently in the Nilgiris, where it is not uncommon in the undergrowth in Aramby, Tudor Hall, the Government Gardens and elsewhere: it was a straggling, soft-wooded, wattle-like plant with pretty spikes of pale yellow flowers, but it did not seem to be particularly noticeable as likely to thrive in such a climate as that above described.

II-CORRESPONDENCE.

Revolution in Systematic fire Protection of Forests.

SIR,

While reading over one of the Central Provinces Annual Provincial Forest Reports for the year 1892-93, one paragraph in it, out of many interesting ones, struck me as being especially so, and that was the additions made to systematic fire protection. It is stated by one of the Conservators that a very large area, some thousands of acres, was added during the year at "no expenditure." This is very creditable; and I am sure all our congratulations are due to the Conservator for this change in systematic fire protection at "no expenditure." Naturally, this has called forth, at the expense of a less fortunate Conservator, the expression of "Well done, thou good and faithful servant," &c. &c., this we do not grudge. But now let's consider a bit. The conditions for fire protection in the Province are not favourable; and at times most difficult to manage without the outlay of a large expenditure. Then how came this fortunate result? Through the agency of the regular protection establishment? Ye gods! What an exemplary establishment to work with! No fire lines, no extra establishment, but only a "hukum" to the forest guard to protect the 10, 20, 30 and even 40 square miles under him: which is the case in the province, and he does so. With modesty the Conservator remarks that the year was an exceptionally favourable one for fire protection, and that these results of "no expenditure" need not be looked for every year. Good, but let's proceed. Further down the Report another tabular statement is given, which discloses facts still more wonderful, but into the history of which we have no insight. About 80 per cent. of the rest of the forests, not systematically protected from fire, did not burn. Who helped to protect these—if not the regular protective establishment? Perhaps the "Kotwar" of the villages? Or it might have been that circulars were posted up on trees which awed the "mowah" gatherers, the "dyah" cultivator, and general traveller into the importance of the "Sarkar's" printed chits.

Judging from the continual cry of the great want of executive and protective establishment in this Province—which want nobody denies, considering that there is an area of some 19,000 square miles of Government forest in it, it appears that the statement showing the very large area of forest as added to systematic fire protection in the Circle during the year, is most highly coloured. Equally coloured results may have been made to the systematic fire protection of the other Circle, and with perhaps better results, but such has not been the case, and so the less fortunate Conservator has had to forego his crumb of praise. No doubt he would have made it up in his next Annual Report, but, alas! as he now says:—"Man proposes, God disposes." He leaves the Province shortly, never to return to his happy hunting grounds. There are other points in the Report which require to be taken up, and no doubt these will be reviewed by abler hands. And that we shall soon see the review of the Report in the pages of the "Indian Forester," I have no doubt.

CAMP, *8th April*, 1894. JO HUKAM.

The Grading of Rangers.

DEAR SIR,

Does not the Forest Department Code, provide that, *cæteris paribus*, Rangers should be graded on Provincial Lists according to seniority of service?

As I read the Code, promotion should be regulated in this way, and if this is the correct reading, the Burma and some other Provincial Lists recently published show a want of conformity to the Code.

In the Burma List of Rangers for 1st January 1894 even a passed student of Dehra Dun with Ranger's certificate is superseded by (among others) an uncertificated Ranger of 4½ years less service as a Ranger and 8 years less service in the Department.

To take an opposite case: a Ranger of 3½ years' service and 1⅔ years as a Ranger, who in the 1893 List was a probationer in the 6th grade, has during the year been promoted to the 4th grade, jumping the 5th grade and superseding several men senior both in service as Rangers and Forest Officers, among them (to take the extreme case) a Ranger of 10 years' service, of which 6 years have been in the Rangers' class.

The reason for the above mentioned cases is that the sanctioned appointments are distributed in a fixed manner to the different Forest Divisions in the Province, and promotion is practically restricted in each Division to the allotted Rangerships. Transfers of Rangers from one Division to another are very exceptional and as a rule not at all desirable, it thus happens that Rangers serving in Divisions to which higher grade Rangerships have not been allotted find their promotion blocked and themselves superseded by junior men for no fault of their own.

Were promotion regulated Provincially, this would not occur. No doubt few Rangers study the Classified Lists, or we should hear some expression of dissatisfaction from them. The injustice exists none the less,

PYINMANA:
18th April 1894.

C. E. MURIEL.

III.—OFFICIAL PAPERS, & INTELLIGENCE.

Notes on Forest Tram lines and Wire tramway in Germany and Switzerland,

by H L. Porter.

Hohwald Railways, Vosges.—In the vicinity of the Hohwald there are three forest railways, *viz.*, one at Welshbruch, one at St. Blaise, and the third at Schorinech. The latter was not visited, as it is similar to the one at St. Blaise. These railways are exceedingly interesting, as the question of forest railways is at present attracting much attention in India, and especially in the Madras Presidency, where more progress has been made than in other parts of India.

The Welshbruch Railway was constructed by the town of Ban, and four other communes, and runs through thick forests. Its length is 11,000 metres (about 7 miles), gauge 1 metre, weight of rails per metre 12 kilogrammes (about 26 lbs.) minimum radius of curves 25 metres, maximum gradient 7·6 per cent., mean gradient 5 per cent From the forest to the terminus outside, there is a down gradient the whole way. The empty trucks are pulled up by horses, the loaded trucks run down of themselves, and require a brakesman for each truck. The peculiarity about this line is that the wheels are provided with a double flange to prevent derailments; this is a very clumsy arrangement. The line is said to pay 10 per cent. on the capital outlay. Personally, I do not see how such a line can pay. The principal expense in timber transport is the cost of loading and unloading. When once a cart or truck is loaded it does not cost more to move a log three miles than it does two. The terminus just outside the forest is about two miles from the Ban Railway station. Did the tramway run to the railway station, nothing could be said against it, but no figures will convince me that loading timber on the forest railway trucks one mile from the terminus, unloading at the terminus, reloading in carts and then carting to the railway costs less than carting the whole way. The profits must be more than swallowed up by the two miles of road from the terminus to Ban. To extend the forest railway to Ban, it would be necessary to take up vineyard land, and this would be too costly.

The second tramway inspected was at St. Blaise a few miles from Rothan. Its length is about 13½ kilometres (8½ miles), gauge 70 centimetres (2 feet 4 inches), weight of rails 16 kilogrammes (35 lbs.) per metre, maximum gradient 7·6 per cent., mean gradient 5 per cent., total cost 100,000 marks (£5,000), and this includes an engine of 50 horse-power and 30 trucks (15 doubles). The minimum radius of the curves is 20 metres. This railway was constructed to work a block of forest of 70 hectares, in which all the trees (silver fir) had been blown down during a gale It was necessary therefore to remove them at once, otherwise they would have become valueless, had they had been left out in the open for any length of time. This line almost throughout its entire length runs along the side of the main road, and crosses it in several places, for it is not uncommon in Elsass and also in Switzerland for railways to run along the road. This saves the cost of taking up land, and no one seems to consider it a dangerous practice. The line has only recently been laid by Forstmeister Bieran, who has taken up forest railways as a study, and has been relieved of his ordinary duties. The work throughout is excellent, and there have been no accidents in spite of the sharp curves and steep gradients. Steam is the motive power. Each truck is provided with a powerful brake, invented by M. Bieran, who promised to send me the plans, but up to date has not done so. The terminus of this forest railway is the St. Blaise railway station. This block of 70 hectares contains 20,000 cubic metres of timber, and it is estimated that by using the railway over 2½ marks per cubic metre will be saved. Not far from Rothan is the Schorinech forest railway similar is almost every respect to the one at St. Blaise.

Forest railway, Zurich.—The forest railways used in the Schwald forests near Zurich are less modern that those in Elsass. The gauge is two feet, the rails which are of all sorts and kinds appear to be about 14℔. to the yard, the trucks and brake arrangements are decidedly primitive, and the permanent way roughly laid down. A railway of this description costs little, as most of the material was purchased second-hand; it doubtless serves the purpose for which it was constructed, *viz.*, for carrying fuel and small pieces of wood, but it would not do for heavy timber. The Schwald forests belong to the town of Zurich, and M. Meislis, the Forest officer in charge, has to turn everything to account to make revenue: he has established workshops just outside the forest, close to the Schwald railway station; here poles are impregnated with sulphate of copper, and billets converted into axe handles, wood wool, and small bundles of firewood. Apart from the question of interfering with trade, and in spite of figures to the contrary, I feel convinced that it would pay better to sell the wood in the rough. Figures are very misleading as they can be made to prove anything.

In the Hohwald forests of Elsass, and elsewhere in Germany and Switzerland, sledges are much used on the hills for bringing down timber and fuel. The best gradient for the sledge roads, so the workmen informed me, was 7 to 8 per cent., it should never exceed 12 per cent., as the sledges become unmanageable. It is surprising what heavy loads can be brought down. I saw sledges piled up to a height of ten feet with billets, and containing from 2½ to 3 cubic metres being brought down by one man. Accidents do occur occasionally through the sledges becoming unmanageable, but this is not often the case.

In the vicinity of Bellinzona in Switzerland (on the St. Gothard railway) wire cables are largely used for bringing down fuel and small timber from the mountains. Regarding the cost, &c., of these, it is most difficult to obtain information, as they are without exception the property of the merchants, who purchase the wood standing from the communes and private owners; there are no Government forests in the neighbourhood. I inspected several cables, which were being worked. Of these the most modern and consequently the most perfect, was one at Arnedo, about half an hour's walk from Bellinzona. The total height is 2,850 metres, cost 10,000 francs (of this sum 1,800 was spent in putting it up), average gradient 28 to 30 per cent., number of supports 11, area of forest purchased 1,500 hectares, time allowed for removal 5 years, estimated amount of produce 15,000,000 kilogrammes, amount paid for the block 35,000 francs. The above information was supplied to me by the merchant who owned the cable. The circumference of the cable, which carried the produce was two inches, and that of the brake wire 1¼ inches. The altitude at the top, as measured with a pocket aneroid, was 4,075 feet and at the bottom 1,900 feet. The system is almost identical with that described by Colonel Campbell-Walker, as existing in former years near Lucerne. It consists of two parallel stationary cables to carry the produce, and of a continuous moveable cable running round a drum at the top and at the bottom; this latter is fixed to the loads and controls them, being itself controlled by powerful brakes acting on the drums at either end. By this means the loads can be stopped at will, and it not only controls the loads coming down, but also pulls back the wheels and hooks, which bring down the produce. The loads are brought to the top station, by means of radiating auxiliary cables, leading from different parts of the block; these auxiliary cables are simple wires, and are worked without any brake arrangement; the loads rush down them at a terrific pace, and are brought up against a thick bank of earth. At Roveredo, some distance from Bellinzona, another cable was inspected; this unfortunately was not being worked.

Timber slides or slips with a semicircular section made of round poles nailed together and wooden troughs made of planks, were inspected at Schwald, the former are used for bringing down poles, and the latter (gradient sometimes 1 in 1) for billets.

The conclusion arrived at by me with regard to forest railways on the continent is that they do pay under certain circumstances; the conditions which obtain at St. Blaise are distinctly favorable, here we have the case of a fully-stocked forest containing only ripe trees; these have all been blown down by the wind, and in order to realize anything, they must be removed at once, it would be impossible to do this with carts, as sufficient carts were not available. In our Madras forests, with few exceptions (in plantations and perhaps on the Anaimalais) forest railways will not pay, as the forests are so poorly stocked. If a railway for the removal of timber is required, the rails should be fairly heavy and certainly not less than 25 or 30 lbs. Toy tramways with rails of 14 lbs. and under should not be used, this has been found out by experience on the Anaimalais. Another important point is that the line should be well laid and ballasted. Wooden sleepers are the best to use; and it is a mistake to suppose that light rails (*e g.*, 14 lbs.) laid down anyhow will serve the purpose, they won't, and constant derailments will be the result, not to mention the bending and contorting of the rails. Good brakes on *each* truck are a necessity; those invented by M. Bieran cannot be improved upon; the side lever brakes supplied by Messrs. Fowler and Co. are not sufficiently powerful; further they are continually getting out of order, and the levers bend or break; the special brake vans supplied for the

Anaimalai tramway were a complete failure In any case, special brake vans are a mistake, as they are quite unnecessary, and an extra expense has to be incurred in moving them about the line. The minimum radius of curves should not be less than 20 yards, and the rails should be bent as required ; it is a great mistake to get set curves from the makers ; they are too sharp ; a single truck may get round them without derailing, but double trucks will not, unless a third or guard rail be used.

Wire cables can be used for crossing deep valleys and for bringing forest produce down steep hill sides ; this would of course be allowable under certain circumstances, but in the neighbourhood of Bellinzona the hills are becoming rapidly denuded, as it would not pay to put up a cable to a block of forest, unless it was to be practically clean felled. Avalanches and torrents are the result, the Swiss Government looks on while the hills are being denuded and their attempts to repair the damage done by re-afforesting practically at its own expense ; as the owners, so the forest-officers informed me, often refused to re-afforest when the Government offered to bear as much as 90 per cent. of the cost ; in this free country it is apparently impossible to acquire such lands as being required for a public purpose. These precipitous hills, which are becoming rapidly denuded, remind one of many hills in the Madras Presidency where the denudation is due to the same causes by overworking and cattle-grazing. As a general rule, it is advisable to leave alone forests growing on hill sides, which are too precipitous for roads, the revenue to be derived is small in comparison with the irreparable damage done ; far better to treat them as forests of protection, and exclude religiously cattle and cutting instruments. If large quantities of heavy timber have to be brought down steep hill slides from plateau or tablelands, a railway with a self-acting incline is preferable in every way to wire cables or slides. For removing trees to the road, there is nothing better than the Indian elephants ; I saw several kinds of screw jacks and levers in use, but the process was slow and costly. Sledge roads could, I consider, be used advantageously in many of our Madras forests.—(*From a Report to the Madras Board of Revenue.*)

Rules for the Training of Junior Assistant Conservators of Forests in Madras.

The following rules, recently put in force in Madras, may be read with some interest in other Provinces by Junior Assistants who are not quite so carefully nursed. We suspect that Divisional Forest Officers in Madras will hardly look with unmixed delight on the appointments of young Assistants to their Divisions. If they really carry out the rules, their lives will be more or less a burden to them.

As the Board regards it as of great importance that Junior Assistant Conservators of Forests should be properly and systematically trained during the initial period of their service, especially in regard to knowledge of the vernacular, accounts and office procedure, it resolves to issue the following instructions, which have been compiled, after obtaining the views of the Conservators of Forests, on the employment of an Assistant Conservator during the first 12 months of his career.

2. For the *first three months*, the Assistant's duty should be—

(*a*) Study of the district vernacular, Forest Law, Forest Code, the other Acts and Revenue Standing Orders in which he has to pass (*vide* paragraphs 40 and 41 of the Forest Code), and such other important orders of the Board and Government as the District Forest-officer may from time to time prescribe.

(*b*) General study and practice of office work.

(*c*) Charge for one month of the correspondence work of the District Forest-office. During this period, the Assistant should be required to dispose of all matters coming up, and submit his disposals for the District Forest-officer's approval, the District Forest-officer pointing out to the Assistant the reason of any corrections or alterations made by him in the latter's drafts.

(*d*) Short tours in company with the District Forest-officer, to be selected as far as possible with reference to the following instructions :—

(i) The object of the tour should be to give the Assistant an idea of the flora of the district and the general conduct of field work.

(ii) Each tour should be made with some specific object, and not merely for general inspection, unless the Assistant should be called on to accompany the Conservator (*vide* paragraph 8 below).

NOTE.—During these tours with the District Forest-officer, the Assistant's practical knowledge of surveying and levelling should be tested and improved.

3. For the *second three months*—

(*a*) Study of the vernacular, Forest Law, &c., as detailed in the preceding paragraph. During these three months the Assistant should also submit, along with each weekly diary (paragraph 6 *infra*), three vernacular *takeeds* written by him.

(*b*) Charge for one month of the accounts of the District Forest-office. During this month, the Assistant should be required to keep the cash book in his own hand-writing, frame and check all estimates, examine all vouchers, and see that sanction (whereever necessary) has been obtained, or that work is not being done in excess of sanctioned estimates.

(*c*) Preparation during the three months of all returns due to the Accountant-General, the Conservator and the Board.

(*d*) Touring as per instructions given in the preceding paragraph.

NOTE.—It should, however, be clearly understood that an Assistant Conservator should not be deputed for any one special work, such as the constructions of a bridge, &c., during the first six months of his career.

4. During the *third three months*, the Assistant's course should be—

(*a*) Study of vernacular, &c., as above. During these three months, the Assistant will submit with each weekly diary six vernacular *takeeds* written by him.

(*b*) To assist the District Forest-officer in the preparation of the annual budget estimates and administration report and in framing and checking the returns necessary in connection therewith.

(*c*) Touring as above.

5. For the *fourth three months*, the Assistant should be placed in charge of a range, it being now left to him to follow up for himself his studies in the vernacular, &c.

6. During the whole of his first year, the Assistant should submit weekly diaries showing in detail the work he is engaged upon to the Conservator through the District Forest-officer and the Collector, who will forward them with such remarks as may seem called for. From these the Conservator will be able to judge whether the Assistant is making good use of his time and whether the direction of the course of his training is as it should be. While the Assistant is at head-quarters, he should daily attend the District Forest-office and record in his diary his hours of attendance, the work done and the subjects studied.

7. Half yearly reports on the Assistant Conservator's work and conduct should be submitted by the Collector to the Board through the Conservator.

8. The Conservator may, for special reasons, vary the course of training prescribed above in the case of any Assistant Conservator under training in his circle; but such variations and the reasons therefore should be stated in the half-yearly reports to the Board. When the Conservator inspects the district during the first year's training of an Assistant, he will exercise his discretion as to taking the Assistant with him during the whole or a part of his tour.

9. After the expiration of his first year, the Assistant should be kept on in charge of a range till the Collector and the Conservator consider him fit to hold a sub-divisional charge. It will now be sufficient to require from him the same Diaries as would be submitted by an ordinary Range or Sub-Divisional officer; but the half-yearly reports to the Board should continue until the Assistant has passed the examinations necessary for his promotion to the 1st grade, or is put in charge of a district.

10. The above instructions will, with the approval of Government, be embodied in the new edition of the Forest Code.

IV.—REVIEWS.

Le traitement des bois en France.

No one has had better opportunities than Charles Broilliard for becoming thoroughly acquainted with the French forests and he has given some of the results of his long and varied experience in a very attractive form in the book before us. Broilliard left Nancy in 1853, and after spending 6 years as Garde Général in the silver fir and oak forests near Besançon, he became Professor at Nancy in 1859, and for 22 years, during the long summer tours of the Nancy students, he visited annually the fine oak and beech Forests of the north of France and the silver fir, spruce and Scotch pine forests of the Vosges and Jura mountains. From 1881 to 1891 he was successively Conservator of Forests at Macon and at Dijon, and since 1891, when he retired from the public service, he has been Editor of the *Revue des Eaux et Forêts*. He has visited all the most interesting French forests in the Alps and between the Vosges and the Pyrenees, as well as those of Switzerland, Great Britain and Roumania, and has become acquainted with nearly every one in France who has taken much interest in forestry, as is shewn by the long list, which he gives in the preface of the present book, of the friends who have assisted him in its compilation.

Foresters in India, South Africa and Australia, who studied under Broilliard at Nancy between 1867-1881 will be glad to read the results of the long and varied experience of their esteemed master.

The silvicultural facts recorded in the book are based on the observation, comparison and study of the phenomena which forest growth presents under varying circumstances, but the Forester is warned not to lose himself in details which might be of importance in gardening We are also warned not to plunge too deeply into the mathematical theories of forestry, which are now so prevalent in Germany, especially as regards the results of the experimental plots, (*stations de recherches*) Their danger, Broilliard imagines, lie in the impossibility of foreseeing the future of a wood from its past history; and that in making thinnings one must be guided by the nature of the soil, climate, species and even of the individual tree, and cannot base one's practice on tables made for the average of woods spread over large areas. There can be no doubt, however, that in Germany the uniformity of extensive areas of pure spruce, or Scotch pine forests is more susceptible of rigid mathematical calculation than the oak and beech Forests of France.

In spite of this dislike for mathematical formulæ as applied to forests, Broillard has explained clearly enough the methods of estimating forests, and of calculating the rate of interest which they produce on capital under different rotations, and he has in this edition introduced for the first time a chapter on the division of a forest among the heirs of a private owner, a matter of considerable importance in France, but one which, Broilliard considers, had better be left undone, as the larger the area of a forest, the more cheaply and efficiently can it be managed.

Another novelty is that he has given up the working of High Forests according to the volume of timber to be cut annually, and proposes to work them by area as in coppice woods. Where the soil is fairly uniform and seed years frequent and regular, such a method may be followed with advantage, and nothing can be simpler than his tables of fellings for an area of 500 acres of oak and beech Forest, with a rotation of 125 years and subdivided into 125 four-acre compartments. He assumes that a mature compartment might contain 128 mature oaks and beech, or hornbeam, the more oaks the better, but with a beech and hornbeam underwood to protect the soil, and prevent the formation of epicormic branches on the large oak trees.

In order to make the seeding felling, he would remove 32 of the oaks selecting the worst of them, or a proportionately larger number of trees if there were a mixture of large beech, when all large crowned beech should be first felled, and all the low crowned hornbeam. At the same time, the underwood should all be cleared away, and the soil partially hoed, if there were a crop of acorns on the trees.

Five years afterwards, he would cut about 24 of the oaks, again selecting the worst, and at this felling, most of the remaining beech or hornbeam beech standards would probably be felled. After another five years 18 oaks would go, and 14 more after another interval of 5 years, thus in 15 years' time only 40 oaks would be left on the 4 acres, or 10 per acre, and these the best of the original trees; and they would be by this time surrounded by a thicket of oak, beech, and hornbeam seedlings, with a mixture of softwoods, such as birch, sallow, wild cherry, &c. He would not fix any definite time for felling these 40 oak standards, but would gradually remove them in the subsequent thinnings as they showed signs of falling off, or when they had attained such dimensions as no longer to repay the proprietor for the sacrifice of capital which he would make in leaving them.

At every one of these successive reproduction fellings, the greatest care would be taken to protect the oak seedlings from the invasive beech or soft woods which might spring up, but regular thinnings would not commence till twenty-five years after the first seeding felling.

The table of fellings for the whole wood of 500 acres would therefore run as follows :—

PRINCIPAL FELLINGS.

Number of Compt.	Area in acres.	Seeding felling.	Secondary fellings.			Final felling.	
			1	2	3		
1	4	1894	1899	1904	1909	?	One-fourth of the standing trees to be felled at each felling, except the last, the date of which is undetermined.
2	...	1895	1900	1905	1910	?	
3	...	1896	1901	1906	1911	?	
23	...	1916	1921	1926	1931	?	
24	...	1917	1922	1927	1932	?	
25	...	1918	1923	1928	1933	?	
Total	100	...	...	...	...		

THINNINGS.

Compts.	Area in acres.		
26—35	40	1894 & every 10 years.	Great care should be taken to protect oak saplings from beech and other species.
36—45	40	1895 & „ Ditto	
46—55	40	1896 & „ Ditto	
56—65	40	1897 & „ Ditto	
66—75	40	1898 & „ Ditto	
76—85	40	1899 & „ Ditto	
86—95	40	1900 & „ Ditto	
96-105	40	1901 & „ Ditto	
106-115	40	1902 & „ Ditto	
116-125	40	1903 & „ Ditto	
Total	**400**		

Broilliard does not wish to obtain a dense growth of oak seedlings, and prefers a few here and there amongst the beech and soft woods, but in case oak should not spring up sufficiently, about 100 oak transplants should be planted in per acre after any of the fellings.

Many interesting extracts could be made from this excellent work which for a long time to come will be the Forest Manual of the French private forest-owner, but the space available in the *Indian Forester* must be considered, and its subscribers are strongly recommended to read Broilliard's book for themselves.

W. R. FISHER.

The Annual Forest Administration Report for Madras for 1892-93.

The most noticeable feature of the Volume before us is undoubtedly the last paragraph of the Government Order, one which will not only be read with amazement by Forest Officers, but has already attracted the attention of the outside public, to judge by an article upon it, which has recently appeared in the *Madras Mail.* The following is the paragraph to which we allude, in which the Government of Madras summarize the results of the year :—

"In conclusion, His Excellency the Governor in Council 'desires to place on record his thorough appreciation of the excel'lent arrangements made by Mr. Arundel, the Commissioner now 'in charge of the Forest Department, for the general supervision 'of his subordinates and for the control of their operations. It is 'observed that Mr. Arundel was able to make tours of inspection 'through ten districts during the period under review, and others 'have since then been visited. The Forest Commissioner holds in 'this Presidency a position analogous to that of the Inspector'General of Forests in Provinces directly under the Supreme 'Government, and it is most desirable that the administration of 'the department should be largely influenced by his personal con'trol. The present report affords ample evidence of the fact that 'Mr. Arundel is fully conscious of this important principle, and 'His Excellency in Council observes with satisfaction that syste'matic arrangements have been made to give effect thereto. The 'orders issued to Conservators and District Forest Officers in 'regard to the regular inspection of the forests under their charge 'form one instance in point, and it is further noted that periodical 'returns are now required of the progress of many operations 'which in former years have been carried on without any fixed 'system. The work of the department is doubtless hampered to 'a great extent by the insufficiency of the present subordinate staff, 'and there is reason to believe that much revenue is annually 'sacrificed on this account. The Right Honorable the Secretary 'of State has for the present postponed his sanction to the pro-'posals made by this Government for an increase to the establish-'ment, and the matter is still under consideration; but His Ex-'cellency in Council trusts that the scheme elaborated in 1891 'may before long be approved, and the administration of the 'forests be thereby placed upon an efficient basis."

It is sad to find that there is not a single word of encouragement to Conservators or Divisional or Range Officers; not a trace of sympathy with the hardship of the drudgery they have to go through; and yet, if we are not mistaken, the Commissioner, Mr. Arundel himself, would be the first to deprecate a Review which, to use a common expression, gives him all 'the halfpence' for the year's work, and leaves the 'kicks' for the Forest Officers. Who can expect that the officers of a Technical Department of the Government, specially trained in special schools to administer estates which require special knowledge and special treatment, can work with the energy and enthusiasm for which Forest Officers have usually been known, if their efforts are to receive no better acknowledgement than this; and if that little praise which most Governments in India find it well to give yearly to those who have best borne the burden and heat of the work, is withheld from them, and given only to the non-professional outsider who is ignorant himself of the technical side of the departmental business. What would be said, if such a thing occurred in the case of a powerful Department like the Public Works? They, too, no doubt, have a non-professional head with the Supreme Government, but the Local Departments are at any rate administered by their own men who are professional Engineers, but we suppose that while Civilians who wished to interfere with, and teach their business to professional Engineers, would be justly laughed at, anybody is considered fit to supervise *Forest* works. Sir Dietrich Brandis pointed out in our pages, in January, what a small outturn of professional forest work there had been in Madras; and the Government of India itself has, if we mistake not, noticed the delay in the preparation of Working Plans, and how, though much had been done in some directions, nothing at all had been done in others. It is now easy enough to understand why: the professional work is clearly becoming quite a subordinate matter, and the efforts of Forest Officers are being directed chiefly to the making of revenue at all costs; and the compilation of records to give honour and glory to a member of a Board of Revenue.

The idea, too, that the Commissioner is in "a position 'analogous to that of the Inspector-General of Forests in the Pro-'vinces directly under the Supreme Government," shows that the Madras Government have but a very imperfect notion of what our Inspector-General's functions really are. The Indian Forest Code describes him as corresponding with Conservators on "profession-'al subjects, including the preparation of Working Plans and 'other matters which do not involve questions of administrative or 'general policy," and otherwise as "assisting the Government of 'India in dealing with the Forest business which comes before it." How about Working Plans? Can Mr. Arundel (we say it with all respect for one who probably is as good an officer as any in his service for the position) say that he is capable of doing in respect to them what the Inspector-General has every day to do? Of course he cannot, and this one matter alone shows the failure of the system which the Madras Government so strongly praises, and how impossible it will be for Forest work in Madras to reach the condition it is in in Europe or in some of the Provinces of India, unless a radical change is made and Forest Officers are released from the incubus which now weighs upon them, and allowed some freedom in bringing their professional knowledge to bear upon their charges and getting the forests they manage into the best condition for supplying the wants of the country. And as regards inspections: has it ever occurred to the gentlemen who sit in their Secretariat Offices and write about the work of others, that inspections may often be carried just a little too far? The unfortunate District Forest Officer of Madras, with a huge unwieldy charge, must have a bad time of it indeed, when he has to carry on his own work and make his perfunctory tours, and be responsible for the details of management, and, as if that was not enough, to spend months on tour under inspection by the Collector and the Conservator and the Commissioner, to say nothing of the occasional tours of the Governor himself. What with inspecting officers constantly about, and written reports called for on every wretched little point in which one of them can find a mare's-nest, it is not surprising that he has not much heart for Working Plans, and it will be no wonder if he degenerates into a sort of machine anxious only to manage to go though his service with a maximum of pay and a minimum of worry. Our remarks may seem strong, but we are convinced that they are fair; and indeed we may now turn to the *Madras Mail* and see if the remarks which that well-known authority has to make are not even stronger than our's. The *Madras Mail* writes:—

"Prior to 1892 each Conservator submitted the report for his 'own Circle. Since that date the Board of Revenue has compiled 'the annual report from the reports of District Forest Officers, received through Collectors and Conservators, and the latter are only 'called on to submit notes dealing with technical subjects, *viz.*, 'natural and artificial reproduction and exotics. The report 'itself and the Government Orders thereon, show clearly that both 'the Board and Government are anxious to prove that the administration of the Department by the Forest Member of the 'Board of Revenue is an unqualified success. This is very 'necessary, for it is no secret that the system finds little favour 'with the Secretary of State, the Government of India, or the 'Forest Officers themselves."

"The Forest Member is certainly to be congratulated on his 'touring. If his tours were not confined to the headquarter 'stations, the inspection of ten districts was certainly a remarkable 'achievement. The same cannot be said of his office work, which 'evidently got into arrears during his absence on tour, for we 'observe that "the revision of the rules under Section 26 of the 'Forest Act engaged the attention of the Board during the period 'under report." This is not the first year that the rules under 'Section 26 have engaged the attention of the Board ; and they 'have not yet appeared. It would be interesting to know whether 'plans of operation, estimates, and such like matters, which have 'to be referred to the Board for sanction, receive the same amount 'of attention If they do, we are not surprised at Forest Officers 'grumbling at the delays which occur. In fact, the length of 'time taken in disposing of the most ordinary matters, constitutes 'not the least of the defects of the Board's administration.

'This is the first year that the Board's Forest Member has 'assumed the *rôle* of Inspector-General of Forests to the Government of Madras, and we wish him every success. But we fail to 'see the analogy referred to by Government, between the position 'occupied by the Inspector-General of Forests to the Government 'of India, and that occupied by the Board's Forest Member. Both, 'it is true, are the respective heads of their Departments ; but 'while the former is a trained Forest Officer, and consequently 'able to give the Government advice on the management of its 'forests, the latter is a Civilian without any forest training, and 'to make matters worse he holds the appointment for one or two 'years at the most. His knowledge of the administration of the 'Department must therefore necessarily be as limited as his knowledge of scientific or practical forestry. The report may, as 'Government says, afford ample evidence of the personal control 'exercised by the Forest Member. If it does, it seems a pity that 'this, his first attempt, should have met with so little success. A 'fall of revenue from Rs. 16,94,215 in 1891-92 to Rs. 15,77,202 'in 1892-93 can scarcely be considered a proof of successful administration. The explanation may possibly be found in the fact 'that Collectors have the sole power of fixing the rates at which 'forest produce may be sold by the Forest Department in their 'respective districts, but we fail to see why the Forest Department 'should be called on to supply fuel at a loss of one pie a cubic foot, 'and minor produce at a loss of ten annas, ten pies per maund. As 'the Conservators have now no power of control, and are merely 'inspecting officers, the Forest Member must be held entirely 'responsible for this fall of revenue, and it is difficult to see how 'strengthening the subordinate establishment will increase the 'revenue, as Government supposes it will, if this state of things is 'allowed to continue ; as the amount of revenue realised must 'necessarily depend on the fads of Collectors. The issue of orders 'by an outsider to Conservators and District Forest Officers, and 'a demand for more periodical returns may satisfy the Government 'that this new departure is a success; but we shall require further 'proof to convince us that the present system of administration, in 'which the Conservators have no power whatever, and are merely 'figure-heads, is superior to that advocated by the Committee com'posed of Messrs. WHITESIDE, W. LOGAN, H. E. STOKES, Sir 'DIETRICH BRANDIS, and Major CAMPBELL-WALKER, and accepted 'by Government in 1882. If the arrangement of 1882, which was 'really a compromise, and gave Conservators in Madras less power 'than was possessed by officers of that grade in other parts of 'India, has not turned out a complete success, it is because too 'little power was given to Conservators, and too much to the Board 'of Revenue. The present arrangement will only intensify the 'evil, for it has taken away from Conservators the little power they 'ever possessed. Continuity of policy is one of the essentials of 'sound forest administration, and this is an impossibility with a fresh 'Forest Member every year,* who is able to reverse all previous 'orders and plans, administer the Department, and work the forests 'according to his own peculiar ideas,—if perchance he has any!"

We hope that this expression of opinion may be read by some of those in authority, and that they may be led to look into the matter, and see what a waste of power it is to have a set of special officers in charge of a special department, but at the same time so to tie their hands and gag their mouths, that they have not only no incentive to work, but no inducement to take any interest in their charges.

As for the rest of the report, we have gone through it, but find very little which is likely to be of any interest to our readers. There are some interesting notes on reproduction which are written by Conservators and not by the Board's Secretary, and these we may refer to later on.

The Timber Trades Journal, Special Issue No. 19.

This imposing thick Volume is an important and interesting issue, which is excellently edited and well got up altogether. There is, added to it, a large and valuable Map of the United States and Canada, which we have consulted with great interest.

The contents of the Volume are very varied, but give an account of the progress of the chief timber trades of the world, with special articles on some of the most important of them.

At page 204 is an account of one of Messrs Churchill and Sim's Wood-Sales, with vignette portraits of the chief gentlemen who are usually engaged in them either as sellers or buyers. Some of the remarks as to personal characteristics are amusing; and we hope they are found so by the gentlemen concerned.

---

*Mr. Arundel has already left and another Commissioner reigns in his stead, possibly holding entirely opposite views.

HON. ED.

Several pages are devoted to an account of Messrs. Rosenlew's saw-mills at Bjorneborg, in Finland, with excellent illustrations, shewing the pitch of perfection to which a large timber business may be brought with modern appliances and care in management.

At page 217 we find a paper on the 'Douglas Pine' or 'Oregon Pine' as it seems to be called in the trade, which is said, without hesitation, to be 'the wood of the future.' We are glad to hear that the forests of the tree are 'practically inexhaustible,' but we cannot help thinking that even such supplies would be the better for arrangements by which fellings could be regulated so as to ensure that the stock is really permanent, and that the reproduction of the species is not forgotten.

The next article is one on the 'Pitch pine trade,' but it is not very clear what species the pitch pine is, and where it chiefly comes from.

At page 219 is an account of the 'Development of the trade in African Mahogany.' What is African Mahogany? We are not aware of any species of *Swietenia* in West Africa, and we shall be glad if anyone will tell us what it is. At any rate it would seem, from the very pretty illustrations which accompany the article, that the logs run to very large size, that the wood sometimes fetches as much as 4*s*. 3*d*. per cubic foot, and that in 1893, 4,983,857 cubic feet were imported into Liverpool.

The 'Timber Industry of New Zealand' is the title of an article at page 226, which can only be read with a certain amount of sadness, for there is abundant evidence that conservancy or reproduction are not of account in New Zealand. As regards 'Kauri' we read:—"The supply is expected to last 'another 30 years, all efforts to replant the forests have been 'abandoned, the tree being of such abnormally slow growth that 'after 30 years it has only obtained the dimensions of a shrub." There are several other species mentioned, all of excellent quality; and we only wish we could think that the contending political parties in the Island would agree to carry out the conclusion which was arrived at long ago, that a Conservancy Department was a necessity, and that that Department should be kept outside ordinary politics.

At page 229 is an account of the 'Forestry Exhibit at Earls' Court, 1893,' which we have read with interest. It must have been a rather curious exhibition, something like a real Forest "Old Curiosity Shop," with Mr. Gladstone's axe in the place of honour.

It is rather strange to hear that the male bamboo (*Dendrocalamus strictus*) is becoming limited in supply. In some of our Burma forests, if we are not mistaken, the authorities would be only too delighted if somebody would come and try to extinguish it.

For us, the chief point of remark is the fact, that here once more we have the old, old story about the origins of forest conservancy in South India, with the usual adulation of Major-General James Michael as the first of Indian Foresters. It seems cruel to say anything against a tradition which his admirers so effusively maintain ; but the real fact is, we believe, that Forest Conservancy (*i.e.*, an attempt at forest management, so to as ensure protection and reproduction, and not merely the felling of timber) in South India was really due to the orders of the Court of Directors of the day on the representations of the Governor, Sir Henry Pottinger ; and it was only when the said Court and Governor grew a little tired of keeping young military gentlemen in the Anamalais to cut timber at a waste of 75 per cent. in the intervals of shikar, that they relieved them, and put in a medical officer of some forest and botanical experience with orders to see what he could do in communication with the Collector of Coimbatore to make arrangements for the protection and reproduction of the forests as well as the extraction of timber. The seven years of incessant exposure were, we believe, productive of an unrivalled collection of shikar trophies, but we doubt if they can show one acre protected from fire, one teak tree planted, or even one big sound teak left standing, because there was not enough advance growth to take its place.

At page 252 we are told regarding 'padouk' that two cargoes were imported last year, as well as several parcels which came to hand indirectly. The wood is said to be steadily making its way and to sell well at *3s.* to *4s.* per cubic foot.

It would be impossible to notice even a part of the many other interesting matters which go to fill up this very complete yearly volume, so we will conclude with the following extract regarding the Bombay timber market.

"To give an account of the Bombay timber trade is rather a 'difficult task, as there is so very little to write about.

'The import during the official period 1892-1893 was as 'follows:—

	Quantity. Tons.	Value. Rupees.
'Teak—		
From Siam	2,594	173,618
,, Straits	79	6,915
,, Burmah	80,550	3,414,614
'Junglewood—		
From Straits	3,093	102,609
'Pinewood and timber—		
United Kingdom	570	50,084
Austria	22	1,526
Germany	79	4,353
Italy	2	153
'African wood—		
Mozambique	86	3,350
Zanzibar	31	832
Madagascar	27	550
'Sleepers—		
From Riga, creosoted in London	69,569 cwt.	222,424
Total value		Rs. 3,980,978

'Teak.—By far the largest import is thus seen to be teak, owing to being the only kind that can with immunity withstand the ravages of white ants.

'Jungle Wood.—Besides teak, a large quantity of so-called jungle wood from Singapore and the Malabar coast is used; principally for the erection of the cheaper class of native huts, sheds, and temporary buildings. It is very seldom cut up, consists of several kinds of woods, and prices run between Rs. 40 and Rs. 50 per ton.

'Pinewood.—Lately deals, battens, and boards, planed and rough, in smaller quantities have been imported from the United Kingdom and the Baltic; but the quantity is still very insignificant; in fact the smallness of the orders necessitate regular steam connection, without which the trade would soon die out, as the natives generally prefer teak, which they can buy at about the same rates.

'Sleepers.—The ports supplying Bombay are Rangoon, Moulmein, and Bangkok. The consumption here is necessarily increased year by year, following the growth of the city. From Bombay there is an export going on to Zanzibar and Mauritius, but is too small to be specially noticed. Both timber and scantlings are imported, and prices range:—Timber, Rs. 50 to Rs. 60 scantlings, Rs. 70 to Rs. 115 per ton of 50 cubic feet, all c.i.f. Bombay. The size of the timber is generally 9 in., 10 in., and 12 in. square, 20 ft. and up long, and scantlings, 3 × 3, 4 × 4, 6 × 6; 12 ft. and up in length, all good, sound, and merchantable, fresh cut.

'Now and then an inquiry for creosoted sleepers appears in the market, when railway building is going on up country; but, as a rule, people prefer steel pans on account of the baneful climatic influence on any softer material.

'In Bombay there is only one saw-mill, belonging to Mr. Alex. McKenzie, a gentleman well-known for his energy and enterprise. In the wood bazaar only native buyers are met with, and stocks amounting to several lakhs can be seen stowed away in sheds covered with palm leaves. The peculiarity with these natives is, that they never insure their goods, having an implicit faith in "Kismet." This belief received a rude shock a month ago, when a large fire took place, destroying about Rs. 400,000 worth, principally teak, and it was a sad sight to behold the ruined merchants sitting crying before the smouldering ashes.

'In Europe, the competitors would have contemplated this destruction with rather indifferent eyes, and certainly done nothing to create fresh starts for their ruined trade brethren. Here a collection was made by the trade, and they are all started again. The East and the West look at things from different points of view."

VI.-EXTRACTS, NOTES AND QUERIES.

A Forest School for Ceylon.

The supplement to the *Tropical Agriculturist* of February last has a note saying that it is proposed to start a school of Forestry in connection with the school of agriculture in Colombo. We hope that this means that the Government of the Colony is going to work the Department properly and put its officers on a proper footing in relation to those of the Revenue Department, at the same time as it constitutes a proper forest estate to be placed under Working Plans of a suitable character.

Artificial Indiarubber from Cotton Seed.

A note in the supplement to the *Tropical Agriculturist* says that a process has been discovered by which a small quantity of Indiarubber (15 per cent. of the whole, it is said) can, with the addition of cotton seed oil, be made to produce an article equal in every way to the genuine indiarubber. Thoroughly efficient and cheap substitutes for both indiarubber and guttapercha are badly wanted, for the use of both these substances are so largely increasing, while at the same time the supply seem to be falling off, so that, whether or no the report about the cotton oil is true or not, it is clear that the chemists ought to work out the subject.

Mercantile aspect of Forestry.

Mr. W. R. Fisher, Assistant Professor of Forestry at Coopers' Hill College, writes to the *Field*:—In these days of agricultural depression the paper published in the *Field*, and recommending extensive planting of ash, is very welcome; and there can be no doubt that ash is a rare tree on the Continent, and that its value, is steadily increasing. At the same time, it will only yield fine timber on moist and fairly deep soil, and will not thrive on dry plateaux or shallow soils.

The calculation of 3,000 cubic feet ash timber on an acre in forty years can hardly be accepted for soils of average quality. The ash tree will not ordinarily yield a maximum quality of useful timber under sixty years; and much of the timber at forty years would be immature branch wood.

As regards oak, English oak can compete in quality and in rapidity of growth with that produced on the Continent; but only on condition that it be properly grown—that is, in mixed, high forests with beech: for oak grown in coppice with standards, as is the custom with us, will never produce the finer kinds of even-grained oak timber, which the dense growth of the Continental high forests supplies. English oak grown in a more open manner will, however, prove more durable and tenacious than Continental oak when grown in the denser way. There is, amongst other similar trees, a fine oak in the Windsor Forest, which has been grown with beech in High Forest, and at the age of 160 years contains upwards of 200 cubic feet of splendid timber, worth at least 2*s*.6*d*. a cubic foot, or £25. As a fact, £100 was once offered for this tree to form a 60 ft. keel for a schooner.

It would be a mistake to reckon on a permanent supply of oak timber from the Continent of Europe. It is true that the oak forests of Germany and France are splendidly managed; but, even so, these countries, and especially France, have to import oak timber for their own requirements, and Germany is much richer in conifers and beech than in oak. What is termed Austrian oak comes chiefly from Croatia, Illyria, Servia, and other Eastern countries where strict forest conservancy is not yet altogether satisfactory; and the present rate of supply cannot last very much longer It would also be a mistake to imagine that the Russian sources of oak supply have not been already greatly reduced.

The figures in the former paper regarding remunerative forestry in Baden and at Rouen do not supply the areas of the forests in question, and are not, therefore, very instructive; but it is a fact that in the highly industrial countries of Belgium and Saxony forest lands will pay 20*s*. an acre per annum, after deducting all expenses of management; and last year, in a private forest in the Belgian Ardennes, near St. Hubert, 17½ acres of forty years old Scotch pine were sold standing for 24,000 frs. or £960, to be used as mine props at a distance of about 130 miles by rail. This gives about £55 per acre, or, allowing interest at 3 per cent. per annum, a clear annual profit of 16*s*. per acre, excluding the value of thinnings which have been made, but the amount obtainable from which is not now ascertainable. These woods cost nothing to plant, as the custom in the Ardennes is to let the land for growing rye for one year after felling, and this pays, for the sowing up with pine seed, which is done either with the rye or in the spring after the rye has been sown, the pine seedings growing up under the rye, and being left with the stubble after the harvest. Six pounds of pine seed per acre, at about 4*s.* a pound is sufficient; and sowing is preferred to planting after the harvest, on account of the drought to which transplants may be exposed on these hill-sides. (*Timber Trades Journal.*)

Seeding of Forest Trees.

The Conservator of Forests, Central Circle, N.-W. P. and Oudh, informs us that *Bijasar* (*Pterocarpus Marsupium*) is fruiting heavily this year in Kumaon as is the *Sain* (*Terminalia tomentosa*). Mr. H. French writes from the Darjeeling Hills that the *Tama* bamboo (*Dendrocalamus Hamiltonii*), has seeded profusely this year, and that seed is available.

VII—TIMBER AND PRODUCE TRADE.

The Indian Timber Trade.

CALCUTTA, *February 21st 1894.*

The timber trade of this port is not very active now, as Burma is exporting largely to Bombay. The demand for teak has risen there; besides, the European markets are having heavy supplies on account of the reported activity in the home and private dockyards. Squared logs only are imported into Calcutta, very seldom round logs; price at present, Rs. 90 to 100 per ton of 50 c. ft.; scantlings, invoice of assorted sizes, running from 1 x 2 to 3 x 12, 5 ft. and upwards, price Rs. 70 to 80 per ton.

Now that the hot weather is rapidly approaching, the trade will decline, but become active as soon as the rains are over, probably in October.

Government and railway companies usually issue tenders now for the supply of teak, which close at the end of this month.

Teak is the chief wood which is largely imported and extensively used for all wood work.

Pine comes occasionally to this port from America, but is not a favourite on account of its great attraction for white ants, which are very destructive. At present a shipment of Oregon red pine is being moved off very slowly; it was landed in the early part of last year ex American ship "Yarkand," and consisted of 1 in. boards, 2 in. and 3 in. deals, and square logs.

Indigenous Woods.—Sál, a hard wood in respect to the Burmah padouk, is the chief wood for building purposes. Soondry and Sissoo, two other hard woods, are chiefly used in carriage and cart manufacture. There are many more which might be turned to account, but for the want of good communication between railroad and forests. The scanty supplies that do come to hand are poor in quality and irregularly sawn by hand pit-saws after the old method shown in your Timber Merchants' Office Calender, 1894.

Box-making.—This is an extensive trade, and is entirely in the hands of natives, who are in the habit of buying up all the old packing boxes from firms and cutting them up. This is, indeed, a line of business which if headed by English enterprise and capital would pay. A mill, with all the machinery required for the trade, could supply the Government Stationery Department, the Medical Stores, H. M.'s Mint, the Telegraph Department, General Post Office—for whom the Pioneer Saw-mills have now an order in hand—besides many large firms trades and hotels, too.

Referring to an article on tea boxes in one of our recent issues, I add my quota of experience. Tea boxes were first made of teak bundled into shooks and imported from Burmah into the tea-growing districts of Assam. About a million yearly would be imported; for a long time garden managers would use nothing but teak; these were supplanted by the Burmese cedar boxes, which cost about two-thirds the price of teak. These have been still further competed with by the wood of the cotten trees (Simul), which grows largely in the lower regions of the Himalayas. These are felled by hand by the Meris and Nagas, wild hill tribes, and floated down in rafts on the Brahmaputra River to the few saw-mills in Upper Assam, where I was manager and engineer to one of these box-making mills. The wood of the cotton tree is almost universally liked by garden managers as its seasons quickly, yields to the nail, and is very light. The logs are quickly cut up when hauled up from the river, ripped up in the frame-saw, then cut in blocks by the cross-cut saw to the length and breadth of the box, then to the small circular saw benches, of which there are about six, to cut the blocks to ½ in. boards, and then removed to some sunny spot and sandy ground for atmospheric drying. I have handled and cut up these blocks myself whilst they were dripping with sap and water, yet a few hours drying out in the sun and on sand would absorb all, and make the boards light as a feather.

Wine cases another line in box-making are which might be developed. Firms here will not wait for the slow process of hand-made boxes, and some have recently written to Swedish firms for supplies.

Soap boxes are urgently wanted for one of the leading soap manufactories here. One has just imported 43,000 boxes at from 2 to 5 annas apiece.

Mr. G. Barton, who has a head office and furniture show rooms at 8, Bow Bazar Street, Calcutta; cabinet workshop in South Road, Entally; saw-mills and timber yard, Howrah, possesses a small business which would bear extension if backed by English capital. He has been brought up to his work in one of the largest saw-mills there, where they had about twenty-five various wood-working machines, and could turn out woodwork of any kind from furniture to doors and windows. Labour is very cheap, native carpenters can be had at from 8 to 12 annas per day—7*d.* to 10*d.*—but the work is slow and inferior. There is no reason why a saw-mill should not pay here. The one referred to paid well, but closed on the death of the proprietor. Sawing for the trade is profitable here. There is no reason why round logs should not be imported from Burmah, and sawn into scantlings for market consumption instead of the timber merchant having to pay Rs. 10 per ton more in freight, *plus* a higher rate for landing and stacking cargo.

There are two small mills owned by natives having Messrs. Thomas Robinson and Son's machines, and one or two of the shipbuilding yards have a frame saw and a couple of benches to do their own work.

IMPORTS OR TIMBER IN TO THE PORT OF CALCUTTA FOR THREE YEARS.

	1890		1891.		1892.	
Month	Tons	Rupees	Tons	Rupees	Tons	Rupees
April	953	41,159	1,653	67,522	1,174	41,275
May	1,784	67,225	1,815	94,881	1,399	74,394
June	1.136	59,038	832	42,553	731	34,409
July	1,549	47,610	2,465	115,403	648	28,311
August	962	64,114	1,297	66,750	1,789	95,622
September	1,821	124,818	1,377	49,358	784	38,719
October	1,011	52,788	1,173	59,788	822	34,053
November	1,515	81,128	1,720	77,640	2,869	158,734
December	1,938	119,521	960	50,093	1,067	48,634
January	1,277	49,897	788	37,339	625	29,539
February	1,085	45,832	1,030	45,805	907	38,567
March	1,483	72,133	893	38,427	1,509	86,806
	16,514	915,263	16,003	744,959	14,669	709,063

Total for three years { Tons 47,186
Rupees 2,369,285.

(*Timber Trades Journal.*)

NOTE.—We extract the above article, though we have a good deal of doubt of some of the writer's remarks.

HON. ED.

Churchill and Sim's Circular.

5th April 1894.

East India Teak.—The deliveries for the first three months have amounted to 3,568 loads against 2,771 loads in the corresponding period of last year. For March alone they are 1,034 against 1,370 in 1893. Prices for stocks in the Docks have been about stationary, but higher prices are obtainable for special sized logs of good quality. Planks continue in good demand, and shipments are readily saleable at the present low rates. There has been little business in cargoes afloat, sellers being still sanguine as to future prospects, and unwilling to meet buyer's views unless with shipments close at hand.

Rosewood—Is only saleable occasionally, and at low prices.

Satinwood—Large and figury logs would realize good prices but for small, plain wood there is scarcely any demand.

Ebony—Moderate imports of good logs would sell well.

PRICE CURRENT.

Indian Teak	per load	£9-10s.	to	£16.
Satinwood	per foot superfical	6d	to	12d.
Rosewood	„ ton	£5.	to	£8
Ebony	„ „	£6.	to	£8

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, April 1894.*)

Cardamoms,	per ℔.	2s.	to	2s.6d.
Croton seeds	per cwt.	20s.	to	27s.6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	15s.	to	30s.
Gum Kino	„	£15	to	£18.
India Rubber, Assam	per ℔.	1s.7d.	to	2s.3½d.
„ Burma	„	1s.7d.	to	1s.11d.
Myrabolams, Bombay	per cwt	8s.6d.	to	10s.6d.
„ „	„	4s.	to	4s.9d.
„ Godavari	„	6s.3d.	to	7s.
Nux Vomica, good	„	6s.	to	11s.
Orchella, Ceylon	„	15s.	to	22s.
Redwood	per ton	£3.	to	£3-10s.
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	to	£30

The Teak Market.

Richardson and Cruddas' Price List, Bombay, *March*, 1894.

TIMBER, VARIOUS.—	per ton of 50 cubic feet.		
Teak Logs and Beams, 1st Class, Selected—	Rs.		Rs.
under 12″ Sidings	87	to	105
12″ to 15″ do.	105	,,	113
Over 15″ do.	110	,,	118

	Per cubic foot.	
Teak Sleepers and Girder Beds, cut to sizes and lengths.	Rs.	As.
Under 12″ wide	2	8
12″ to 15″ wide	2	12
Over 15″ to 18″ wide	3	2

	Per cubic foot.	
Teak Planks, cut to sizes and lengths—	Rs.	As.
Under 12″ wide + over 2″ to 3″ thick ...	2	14
12″ to 15″ do. + do. do. do. ...	3	6
15″ ,, 18″ do. + do. do. do. ...	3	12

Cawnpore Price Current.

March 29th, 1894.

	Per Maund.						
	Rs.	A.	P.		Rs.	A.	P.
Aonla fruits, dried	0	12	0	to	0	12	6
,, leaves, dried bruised ...	1	12	0	to	2	0	0
Babul Bark	0	7	0	to	0	8	0
Bahera	1	12	0	to	1	14	0
Lac, Stick	24	0	0	to	25	0	0
Myrabolams	3	0	0	to	3	8	0
Moonj Grass	0	8	0	to	0	9	0
Gum, Babul	13	0	0	to	13	8	0
,, Mixed	9	0	0	to	10	0	0

Statement of average selling rates of timber and bamboos in Meerut, Cawnpore, Bulandshahr, Bareilly and Moradabad for the quarter, ending 31st March 1894.

Description.	Timber Scantlings per score.		Bamboos per 100 score.		REMARKS.
	From	To	From	To	
MEERUT.	R. A. P.	R. A. P.	R. A. P.	R. A. P.	
Sal 10′ Tors (Poles) ...	8 0 0	18 0 0	...	...	
Sal & Sain, &c., Karris, 12′ × 5″ × 4″ ...	25 0 0	40 0 0	...	...	
Sal bed posts, 7′ × 2½″ × 2½″ ...	10 0 0	12 0 0	..	...	
Bamboos of 9′ to 10′ per 100 score ...	...	...	40 0 0	100 0 0	
CAWNPORE.					
Sal 10′ Tors (Poles) ...	5 0 0	6 0 0	...	...	
Sal, & Sain, &c., Karris, 12′ × 5″ × 4″ ...	25 0 0	80 0 0	...	...	
Sal bed posts 7′ × 2½″ × 2½″ ...	12 0 0	15 0 0	...	...	
Bamboos of 9′ to 10′ per 100 score	...	...	25 0 0 30 0 0 50 0 0	30 0 0 50 0 0 100 0 0	
BULANDSHAHR.					
Sal 10′ Tors (Poles) ...	...	...	...	..	
Sal and Sain, &c., Karris, 12′ × 5″ × 4″ ...	...	.	.	...	
Sal bed posts, 7 × 2½″ × 2½″ ...	...	...	...	..	
Bamboos of 9′ to 10′ per 100 score ..	.		80 0 0	90 0 0	
BAREILLY.					
Sal 10′ Tors (Poles) ...	5 0 0	10 0 0	...	...	
Sal & Sain, &c., Karris, 12′ × 5″ × 4″	25 0 0 40 0 0	35 0 0 50 0 0 60 0 0	.. ..	.. ..	
Sal bed posts 7′ × 2½″ × 2½″ ...	10 0 0	15 0 0	..	...	
Bamboos of 9′ to 10′ per 100 score ...	...	..	50 0 0	137 0 0	
MORADABAD.					
Sal 10′ Tors (Poles) ...	20 0 0	25 0 0	...	...	
Sal & Sain, &c., Karris 12′ × 5″ × 4″ ...	30 0 0	50 0 0	...	...	
Sal bed posts 7 × 2½″ × 2½″ ...	0 8 0	0 10 0	...	...	
Bamboos of 9′ to 10′ per 100 score ...	...	...	50 0 0	100 0 0	

THE

INDIAN FORESTER.

Vol. XX.] June, 1894. [No. 6

Vallombrosa and the Royal Italian Forest School.

On the Eastern banks of the Arno, a mile from the city gates, rises a small hill, on whose crest are to be found the ancient remains of Fiesoleum, a name not unknown to the student of Roman History, and interesting as having formed the first beginnings of the present city of Florence.

The slopes of the Hill of Fiesole are studded with picturesque villas, (everyone has lately heard of Villa Palmieri and Villa Fabbricotti, Queen Victoria's temporary abodes), from which enchanting views of the Arno valley are to be obtained; but nothing can equal the view from the summit of the hill itself. Florence, spread along the banks of the silvery Arno, brings to one's mind thoughts of some ancient walled citadel, though in this case encompassed by a wall of mountains, the blue Apennines. On the north these rise to a great height, culminating in Monte Morello, a prominent eminence, on which the eye must often rest, if only on account of the saying that when Monte Morello is capped with clouds, the wise Florentine should not forget his umbrella.

Towards the close of autumn, as the usually bright and sunny Florentine winter sets in, from Fiesole's breezy outlook, facing to the south, may often be seen in the far distance on a rising point of the Apennines, a patch of white snow, rendered the more conspicuous by the black ground on which it appears to lay. That is Vallombrosa, the valley of shade, the abode of the Royal Italian Forest School, a place unrivalled for the beauty of its scenery and of its woods, and to which we now propose to proceed.

Leaving Florence by the Rome express, the so-called 'lightning train,' (*treno lampo*), at 7-30 A. M., the passenger alights at the little station of St. Ellero at 9 A. M. Here a small mountain train is in readiness to take him to the heights above. The railway line is constructed on the rack system, *à cromallière*, as it is termed by the patentee, Count Telfener, the constructor of this railway. The line, which is 8 kilometres in length from St. Ellero to Saltino, rises very abruptly, and in places the slope reaches an inclination of 22 per cent. The wagons, which are 11 metres in length, and 2·30 metres broad, are capable of seating 56 passengers, the train being generally made up of 2 carriages, which are pushed forward by an engine attached behind. By the time the first station, Donnini, is reached, distant 3 kilometres from St. Ellero, the train has already risen 326 metres above sea level. At Filiberti, the second station, about 1½ kilometres from Donnini, the height reached is 418 metres. From this place the slope increases, and after rising for a distance of about 3 more kilometres, the terminus, situated on the small plateau level of Saltino, which is 1,000 metres, is reached.

The Railway itself is said to be of the safest, both in the system adopted, the *cromallière*, and in construction ; and the line is carefully guarded by "Choukidars" placed at close and regular intervals. Still the traveller may well feel ill at ease, and feel that he is tempting Providence when crossing some of the grander passes where space, and space alone, appears to intervene between him and the abyss below. But the traveller in these parts may trust himself with confidence to the Providence, which if the local legends be credited, has often intervened in a miraculous manner to preserve the unwary pilgrim. Close to Saltino itself, near the Paradisino, is to be found a rock bearing the impression of "Saint" Giovanni Gualberto. History relates that "Shaitán" one day to please a wicked whim wished to push the saint into a torrent, but the man of God leant against a stone, which lay close by, and the stone at once becoming soft as wax, enabled it to receive his body and hold it back from the abyss. But, on the other hand, the wicked may well shudder ; for at one of the worst points is not the so-called "Masso del Diavolo" pointed out to this day? So-called, because when the monastery at Vallombrosa was first started, a novice fled, wishing to return to the world ; but no sooner had he removed his monk's attire than the Demon appeared and threw him into the horrible chasm below. A long and beautiful inscription bears faithful record of this occurrence. At any rate on our journey, we may well hope that if an accident does occur, all the rocks will doubtlessly turn to wax.

Many are the writers who have described the beauties of this valley ; but for a description of the journey, the ride from St. Ellero to Saltino, the words of a well-known Italian writer, Raffaele de Cesare, may well be quoted :—

"Along the winding road, which leads from Pontasieve to Vallombrosa, each turn lends enchantment to the view, but when the road enters the forests, leaving the 'zone' of the vine and the olive below, it seems to lead one into a Gothic temple, stretching to infinity. The towering pines almost entirely shut out the skies, and the road, bordered by closely-packed chestnut trees loses itself in the dark uncertain light. The forest has all the appearance of a park; the usual thickets and forest plants are wanting; the ground, in many places, is even grassless. In the denser parts of the wood, no air, no light for undergrowth. Right up to the monastery one marvel of scenery follows another, the more enjoyed in so refreshing and cool an atmosphere."

At Saltino, the terminus of the Rack Railway, a fine Hotel of magnificent proportions has been erected, where every comfort of modern times may be obtained: and above all, from the terrace running along the Northern face of the Hotel the view is stupendous. At one's feet lies the whole valley of the Arno, every inch to be clearly discerned, each hamlet, each castle, each house may be made out; in fact, the whole of the fertile plain of Cascia, with its hamlets of Incisa, Rignano, Figlino, San Giovanni, Montevarchi and Pontasieve. Lounging on the terrace on a summer's eve, smoking a cheroot, the sunset is a sight not easily forgotten.

In connection with Saltino* and the origin of its name a sad tale is related. A certain man wearied of the cares of life, having wended his way to this spot, his last paradise, took *a little jump* into the precipice below. If it is indeed true that this legend has given its name to the place, it is certainly equally true that it has not imparted to it any of its melancholy sadness.

From the Hotel at Saltino a short stroll leads one by a good road, the same along which we may imagine *San Giovanni Gualberto* himself first came, though the original path has lately been enlarged, planted with shady trees, to Vallombrosa, the site of the old monastery, the present Royal Italian Forest School.

Nine centuries ago young Giovanni Gualberto, a knight-errant, came to this spot. Wearied and foot-sore he sat him down under the pleasant shade of a beech tree, which let down its leafy boughs to surround him and protect him from all danger.

At the same time a pure crystal stream of water sprung from the roots of the tree. The Faggio Santo, the sacred beech, is still pointed out. Apparently Gualberto, either to perpetuate his gratitude for this act of grace, or taking this occurrence as a sign of heaven, set about founding an order of monks, known as Vallombrosani, who, settling down at Vallombrosa, built a monastery and rapidly increased in reputation, honour and riches.

---

*Saltino=small jump (salto.)

The monastery is an enormous solidly built palace, with 3 towers, without any pretentions to architectural beauty of design, though stately in its severe outlines. There are spacious court-yards, vast porticoes, a verandah, some 50 metres in length, leading into the cells, which were to all appearance roomy and gay. The church is large and airy, but has nothing noteworthy with the exception of a number of relics, among which may be mentioned the arm of Saint Giovanni Gualberto, the founder of the order. There is in fact nothing worthy of notice unless, taking an interest in culinary matters, we enter the kitchen. Here is to be found a fireplace, which is situated in the centre of the kitchen, and reminds one of some ancient Hindu temple, for it consists of a beautifully designed "cupola," supported by 4 massive columns. At first sight it is only possible to imagine that the dome must have protected some heathen shrine ; but the mind quickly turning to more wordly thoughts conjures up visions of the numberless lambs, and pigs, and wild boars, and even calves that hung up whole, must have slowly been brought to the right degree of crispness, while the happy and fat Vallombrosani monks, clothed in their loose flowing robes, sat on the platform around that central fire warming themselves, and licking their chops. O tempora ! And if such was indeed the case, the monks tearing themselves from that enchanting spot, must have been somewhat rudely brought back to a sense of their position by reading over the door of the refectory the motto which still exists ;—"L'Amor di Dio non consiste nel mangiare e nel bere,"—(the love of God does not consist in eating and drinking)—a saying which the monks evidently forgot in the year 1866, though perhaps not for the first time, when the decree of suppression was about to be issued. On that occasion, after selling all the lands they could, and collecting their wealth, they divided equally amongst themselves and went their way. Still it is always a consolation to think that if the church and Convent are no longer what they were, the good works of the monks remain after them ; the forests remain, which defy all time.

The territory of Vallombrosa, which formerly belonged to the "Monaci Benedettini della congregazione Vallombrosana," as already stated, is to-day the property of the Domaino dello Stato, thus assuring the permanent retention of the vast forests to the State, and has utilized the old and roomy convent buildings for the housing of the Italian Forest School. There are about 50 students in the College, who after completing a special Course of study extending over 4 years, are appointed Assistant Sub-Inspectors of Forest. (Sotto—Ispettori Forestali Aggiunti). The School, which gives an excellent forest education, is under the directorship of Comm. Ing. F. Piccioli, who is doubtless well-known to all students of Continental Forestry for the number of excellent text books he has written on forest matters. He also edited for some time at considerable personal expense and cost, a Forest Magazine, which has lately been abandoned for want of support. The assistant professors are Cav. P. Nico for Mathematics ; Sig. R. Sulla for Botany ; Cav. V. Perona for Sylviculture ; Sig. Gatti Menotti Garibaldi for foreign languages, and a few others.

The lovely woods of Vallombrosa are situated on the Northern slopes of the Tuscan Apennines, and reach a height of 1,446 metres. The forest vegetation of Vallombrosa is said to be amongst the richest of Tuscany for the number and varieties of its plants, and indeed may this seem possible after a perusal of a very interesting little work, a botanical guide book to Vallombrosa, published by Lodovico Piccioli in 1888. (Guida alle escursione botaniche nei dintorni di Vallombrosa).

Many generations of men, dedicating themselves to a life of ascetism, taking under their special care the protection of souls *and of trees*, for eight centuries, used every endeavour to clothe those heights with a pleasant verdure. Bleak and desolate spots under their patient care were converted into magnificent and stately forests.

It is now over 9 centuries, as already described, since San Giovanni Gualberto first took up his abode on these heights and founded the order of Vallombrosani. Soon after its foundation many people came forward to endow the monastery with lands, chief among the donors being Corrado il Salice, a devout prince, and Ghioella, a pious court lady ; and, in the hands of the monks these lands assumed new features. It is to the monks that the transformation of those lands from mere barren wildernesses into pleasant hills, thickly clothed with forests, is due ; and one can only feel grateful to them, the more so on account of their being no longer there to reap the fruit of their labour. The students of the Forest School have taken their place, and the woods are the property of the State.

Down below, close to the bridge of Tosi, commence the chestnut woods, which, occupying the lower level, stretch far away into the Milosa plain, yielding large and luscious sweet chestnuts of excellent flavour. As the road rises, however, and Fossacormoti is reached a change in the atmosphere is already felt, and the imposing pine forests are entered ; and what at once strikes the eye *are* the wonderfully regular lines in which the pine trees, with almost truly mathematical precision, are planted. They have been described as having the appearance of a huge army drawn up in regular, open battle array. Rising still further to some open spot, the next thing which strikes the eye is the ease with which the different age classes may be distinguished, forming as they do a pleasing study in greens, a dark green for the patriarchs, a lighter green for the young men, and a very light pale green distinguishes the youngest. In these forests, which are treated on a selection system (jardinage) with rotation of

100 years, the darkest-green is the prevailing colour, for the old trees are still in the majority, and it is these older trees rising like mighty giants that lend majesty to the scene. The sight is indeed most varied, and it is impossible in a description to do full justice to a scene, which filled Milton, Ariosto, and many others with enthusiasm. Thus Ariosto describes the scene :—

> " Cantan frai i rami gli angelletti vaghi,
> Azzurrie e bianchi, e verdi, e rossi, e gialli.
> Murmuranti ruscelli e cheti laghi,
> Di limpidezza vicono i cristalli :
> Una dolce aura che ti par che vaghi,
> A un nodo sempre, e dal suo stile non falli.
> Facea si l'aria tremolar d'intorno.
> Che non potea noiar calor del giorno......"

And, in the pinewoods many are the shady spots, pictures which remind one of Doré's illustrations to Dante's Inferno, veritable abodes of nymphs and goblins—one's idea of the Walhalla of Scandinavian mythology. One particular wood, planted at the commencement of the century close to the Monastery, on the steep, precipitous slopes of a hill, where the clear pine boles, so carefully aligned at such regular intervals that they appear to form so many columns supporting the leafy dome above, cannot differ very materially from that which gave Milton some of the most sublime inspirations to Paradise Lost.

Many who will remember the correspondence which appeared in the *Pioneer* a few years ago regarding the acts of vandalism the Indian Forest Department were supposed to be perpetrating by felling some of the old and picturesque trees in the Dún, may appreciate the following extract from an Italian paper the *Corrière di Napoli* :—

" Neither the Alps nor the Pyrenees can offer so stupendous a sight, and, perhaps it is, alas, more than certain that Vallombrosa itself will be able to offer it no longer when with the lapse of time, the beautiful century-old trees of the woods planted by the monks will have been replaced by the less regular plantations, made with less patience, of the Forest School."

Unfortunately those who have visited the magnificent and picturesque, " scientifically " formed German forests cannot feel any alarm or be moved by such writings.

In addition to the chestnut and pine forests, far away on the Eastern limit of the Pine, the zone of the beech is entered, forming many interesting woods.

The whole of the Government estate is easily accessible, the Forest School having constructed good, shady and wide roads, and paths leading to the more inacessible and steeper points. Needless to say that the number of walks and excursions from the Hotel is endless: a climb to admire the sunrise at Secchietta, the highest point, 1,500 metres above sea-level from which the most extensive panorama may be enjoyed, as it were touching Florence with the one hand and Siena with the other, the whole of Etruria at one's feet; a stroll through the woods to the "Lago," the Eastern limit of the State forests, and to the "Bocca del Lupo" the western limit; then, further away and outside the limits of the State domain to Camaldoli and l'Alvernia, into the Mugello and the Casentino, to the castles of Vincigliata and of S. Mezzana di Panciatichi; and many more, too numerous to relate.

For the shikari again, Vallombrosa has its charms. Partridges, quails, hares, wood-pigeons, doves, used to abound, as well as squirrels, though a shooting permit from the Minister of Agriculture is necessary, except in the case of squirrels. The slaughter of these animals is actually encouraged. They cause much damage to the pine trees, and consequently a reward of 20 centimes per squirrel-tail may be obtained from the Department of Agriculture, a practice which also exists in many Scottish forests. Bears, it is to be feared, have quite disappeared, though these appear to have existed in past ages. On the walls of the Monastery, where many of the miracles performed by the San Giovanni, the founder, are inscribed may be read the following:—"Il Santo ordina me converso di andare ad ammazzare un orso in una grotta e il converso va e l'orso exe dalla grotta per farsi ammazzare." Perhaps modern bears, even if they existed at Vallombrosa, would not be so amenable to reason.

In the Monastery itself a bright new visitor's book is still kept, and though all the scribblings bear witness to the charms of the place, it is necessary to turn to the pages of a more ancient and long disused volume to find anything worth transcribing. A French visitor, breaking into poetry, thus addresses his invocation to Vallombrosa:—

"De ces monts surcilleux qu' habitent les orages,
Que l'etranger visite ainsi que les nuages,
Qu'il est doux de prier avec un doux amour,
De rever au bonheur de l'éternal sèjour.
D'ici je crois ouïr des paroles étranges :
Est-ce la voix des Saints, ou les concerts des Anges ?
Ici je comprends mieux du ciel l'immensitè,
Et voudrais ni élaucer vers l'immortalité."

Whilst yet another Frenchman wrote:—

"L'oubli, le calme de l'esprit, la paix du cœur sont possibles dans une sembable retraite. Les grands spectacles de la nature doivent contribuer á rendre l'homme meilleur. Demeure delicieuse de Vallombreuse, Adieu! Sèjour des anges, oú y domine le beau et le sublime, oú jouissant de la vraie beauté de la nature on s'approche á son Dieu: Adieu!"

A. C.

The Herikalgudda Forest. By N. Narayen Rao, Forest Ranger, Hassan.

This hill forest is situated in the Arsikere taluq of the Hassan District, Mysore. It derives its name from Herikal, a huge rock, measuring 40 feet in height by 360 feet in girth. The group of hills measures about 58,800 acres, or 92 square miles in extent, and possesses a varied flora. The highest peak is Kare-kulloo, 4,300 feet above sea level. The circumference of the base of the hill is 21¼ miles, and a cleared line, 22 yards wide, separates it from private holdings and other district or unreserved forests. On one of these hills is situated a temple of Sri Venketramananaswamy, a shrine of great antiquity. It is known as Malekal Tirupathi. A flight of 1,750 steps leads to the top, and the ascent of these steps is supposed to be an efficacious substitute for a pilgrimage to the famous Tirupathi shrine in North-Arcot. A Rathotchavam or car festival is held at Tirupathi at the foot of the hill in Ashada, in July each year, and about 3,000 to 4,000 people attend.

There are some temples, partly in ruins, and other monuments which indicate the existence of a city on the Herikal hills in former times; and it is understood that during his wars with the Mahrattas Hyder Ali removed his people to form a city at Nagpuri on the Herikal hills. The circumference of the plain on the hill is 11¼ miles.

The hills are of primitive formation, chiefly granite, and this is abundant, and is fit to be quarried for building purposes by the simple application of heat. The entire group is composed of several rocks or rugged hills, each of which has a name given to it, which is taken from some romantic incident of its own. There are 65 hillocks of the kind.

Around the hill are several villages, more or less thickly populated; and each village has a pass of its own to go up the hill and join the common Nagpuri-Bylu (plain), wherein is situated the Sri Shankeriswara's temple, the common god of all persons of the Shivaite sect, residing in the villages round the hill. All these passes are ascended by very steep paths, only practicable for pedestrians.

It was years before this hill forest could be brought under reservation and the management of the Forest Department. The question of reserving it was first mooted about the year 1872, when Colonel Hill was Deputy Commissioner of Hassan, and after much opposition on the part of the ryots and trouble in the acquisition of two private rights in the forest, it was finally reserved in the year 1882 after a period of 10 years had elapsed in a struggle with a heavy file of correspondence. The difficulty lay, as usual, in the fact of the ryots not appreciating the value of the conservancy of the forests.

It is very probable that the hill may have been well wooded during the time of the poligars, as on many of the hills traces are to be seen of forests cut down long ago, and this statement is confirmed by the existence of fine trees in inaccessible places, and of kinds of trees which are not generally cut by ryots for timber, &c. Between the time of the poligars and that of the conservation of the forest by the State, cultivators appear to have cut down whatever they required for agricultural implements, &c., regardless of the destruction caused to young trees and saplings. No one ever thought of planting new trees to replace those that had been felled, and so, as population increased and agriculture spread, the remaining trees rapidly disappeared. The denudation of trees from which the taluq suffers has probably much to do with the prevailing drought, there being scarcely any vegetation to arrest the passage of the monsoon clouds which float onwards without depositing their valuable contents.

Since the Forest has been taken under the management of the Forest Department, and particularly during the more recent years, much has been done to improve its condition, notwithstanding its defective situation. All possible efforts to encourage natural reproduction are being made. Roads have been to some extent cut through the forest, and at intervals spacious alleys have been made to serve as a means for arresting the march of destructive fires. A fire in this hill forest means terrible damage done to the standing stock, the advance growth, and the destruction of all fallen seed, the germ of future plants. Now the whole forest is divided into 8 parts, with cleared lines of 10 yards wide running from north to south, east to west, north-east to south-west, north-west to south-east, measuring in all 38 miles in length, thus giving scope for the easy arrest of fire, with the help of but a few men.

Fire in this forest is not generally the result of any natural causes. It is generally understood to occur from cattle tenders, who at their midday halts either to secure early and better growth of grass or for no reason whatever set a light to some dry grass, which in its turn communicates the flames to the underwood, and passing on through the long and tufted grass, in a little while the whole forest itself, covering each hill, forms an immense conflagration. Such sad occurrences are now put a stop to.

Though this hill forest cannot be compared with any of the evergreen forests in the west, and is but a scrub deciduous forest, it is important on account of its situation in an arid taluq like Arsikere, and its close proximity to the Railway. Trees of average growth and sufficiently large for ordinary house-building purposes are to be found in all low-lying places. The shrubby kinds are invaluable for fuel. The dominant species is bamboo (*Dendrocalamus strictus*), and the tree growth elsewhere is poor, both in quality and species, and the Forest Department is helping the reproduction

The timber, as a rule, is not of good quality and size, but is valuable in the absence of better kinds in the vicinity. There is, however, a good deal of advance growth at the lower levels: where this is wanting it is proposed to aid the natural reproduction artificially.

Teak seldom grows here much above 8 inches in diameter, the timber being much heavier and the concentric rings much closer together. This is probably due more to its growing on a hard laterite soil, the growth, however, being small and stunted, and having generally an appearance of arrested development. The Herikalgudda is peculiarly adopted for the growth of gallnut trees (myrobalams). In a favourable season the production of gallnuts has amounted to nearly 5,000 maunds, realizing Rs. 5,000 or more. The galls of this forest are much valued on account of their weight, their bright yellow colour and the greater percentage of tannin they are said to possess. These are sold at much higher rates than the nuts grown on trees elsewhere in the district if not in the province. Noticing the spontaneous growth of this tree in the forest, its speedy attainment of fruit-bearing power at the early age of 6 years, its longevity for upwards of 150 years as other arborescent plants, and the large revenue to be derived from it, all efforts to encourage reproduction are being directed towards Alale (*Terminalia Chebula*), the most valuable species in the forest.

The *Phyllanthus Emblica* grown here is noted for its flavour; and the size these gooseberries attain is immense, and is peculiar to Herikalgudda, and Herikalgudda alone, in the district.

The much-valued satinwood tree (*Chloroxylon Swietenia*) is found growing in this hill forest. These trees, though of large size are of great age, so that most of them are hollow and useless. Some measures to aid the natural reproduction of this plant may not be unprofitable.

Sandalwood grows in this forest among rocks where the soil is good, and the trees in such places though small contain more oil, and have a better perfumed wood, especially where the soil is red and stony. The soil of the Herikalgudda Forest being generally white, stony soil, Sandal arrives at maturity between 16 and 20 years; and though the growth is stunted, the wood is heavy and has an excellent scent, with a pale red color.

Tangadi (*Cassia auriculata*) is plentiful on the outskirts of of the hill, and bears flowers and fruits without cessation, and when in flower gives a brilliant colouring to the landscape. The royalty on the bark of this plant is fixed at Rs. 20 per cart-load; and there are many other products which can largely be developed, but for the inaccessible nature of the forest.

This State Forest has been supplying fuel for a few stations close to it on the S. M. Ry., and nearly 20,000 tons of fuel have been felled and removed. The cutting of fuel is conducted on coppice principles, and the forest coppice growth is expected to come up well.

Though this is a deciduous forest, the trees are only more or less deciduous in the dry months of January, February and March, and the forest is never entirely bare, for many trees burst into flower in February, and leaf themselves rapidly, before others have finished shedding their leaves. Still, these tracts have a forlorn appearance in the hot season. But in a favourable season this hill tract is not wanting in those charms of wood and water which tend to soften the harsher features of a rugged landscape, for though the summits rear themselves bare-headed, the slopes are tolerably clad with forest, through which the shining water-courses flow, and supply the vast expanse of tanks below. There are numerous kattays or depressions embanked for the collection of water throughout the hill.

Several systems of improvement of this forest are engaging the attention of the District Forest Officer. Under the systems contemplated, and under a regular system of carrying them out, this extensive hill forest will at some future date become a mine of wealth to the State.

To a shikaree this forest is not less enticing, for these rocky hills give shelter to numerous wild beasts, among which the tiger, cheeta, bear, spotted deer, wildpig and porcupine are most common.

N. N.

The Hill forests of Bashahr.

Bashahr is a hilly tract of land, stretching southward from the Chinese frontier down to Kotgarh in the Sutlej valley. On its west lies Kulu, separated from it by a vast chain of snowy mountains, and its eastern boundary rests upon that main ridge which forms a division between the Jumna and the Sutlej drainage areas. Simla, the largest sanitarium in the Punjab, better known as the summer capital of the Indian empire, is situated on this eastern ridge.

The whole country is drained by the Sutlej. Numerous streams which flow down Bashahr hills run into this river; the chief among these are the Baspa, the Wangar, the Ganwi and the Nogli rivers. The largest of all these tributaries is the Baspa river, which takes its rise from Chor Ghati, and joins the Sutlej at Karcham, some five miles above Kilba, at which latter place are the head quarters of the Bashahr Forest Divisional Officer.

Above Karcham the district divides itself into two valleys:

(1) The Baspa Valley, which adjoins the Jumna Valley.
(2) The Spoo valley.

Between these two valleys rises the mount Kailas, whose loftiest peak is above 21,000 feet high.

The whole district is rocky. The slopes exposed to south and east are generally without much soil on them. Such slopes are of course bare more or less according to their circumstances.

The slopes facing to west or north-west are, however, gentle and moist. The greatest part of these latter slopes is covered with forest growth. The rocks above Rampur are generally crystalline —either gniess, granite or mica-schist. The arable area is scanty, for which reason the district is not well populated.

The men are generally of idle habits. They still keep the old custom of polyandry among them, consequently a large number of females have to lead an unmarried life. And in the upper portion of the district, where Buddhism prevails, many females voluntarily become nuns.

It is of course a well-known fact that the character of the forest vegetation depends much on the influence of climate. Perhaps nowhere in the Punjab is the difference in the vegetation of the dry and moist regions so sudden and marked as it is in this district. I may therefore divide the Bashahr forests into two regions of climate—

(1) The forests below Wangtoo in the moist region, with an annual rainfall above 18 inches.

(2) The forests above Wangtoo in the dry region of climate.

It is of course true that besides climate there are other causes as well, such as soil, aspect and altitude, which have a great influence on vegetation in the hills, but it should be remembered that in this paper I would always speak of otherwise similar localities under these two different climatic divisions.

Before we cross Wangar bridge the appearance of the olive trees, which are found scattered on dry slopes all about there, brings home to our mind that we are now in the dry region of climate.

The following trees of the moist zone may be mentioned, amongst those which we leave far behind at *Nachar* and in the Ganwi and Nogli valleys where the rainfall, at least, during the rainy season, is often great. The holly, the grey oak (*Quercus incana*), *Albizzia julibrissin*, *Rhododendron arboreum*, *Rhus semialata*, *Corylus colurna*, *Andromeda ovalifolia*, *Symplocos cratægoides*, *Cornus capitata*, *Prunus Padus* and *Prunus Pudduam*.

Again there are others which extend to the vicinity of the dry zone, but gradually disappear at or near Wangtoo. The principal trees amongst these latter are the following :—

Pistacia integerrima, *Pinus longifolia*, *Æsculus indica*, the hill mulberry, *Acer caesium*, *Rhus Wallichii*, *Rhus Cotinus*, *Ulmus Wallichiana*, *Buxas sempervirens*, *Cedrela serrata*, *Cornus macrophylla*, *Quercus dilatata*, and *Q. semecarpifolia*.

The numerous shrubs such as *Zanthoxylum*, *Prinsepia*, *Berberis*, *Desmodium*, *Viburnum* and Brambles, as also various ferns and climbers of the moist climate all vanish in the dry region.

Now I proceed to consider the vegetation of the dry zone above Wangtoo. The following species are quite absent in the moist zone. They may be said therefore the most characteristic trees of the dry climate :—

Pinus Gerardiaxa Juniperus excelsa, *Quercus Ilex*, *Olea cuspidata*, a small leaved ash, the poplars, the almond trees, as also the different varieties of grape vines. But the most important trees of the Himalayas do not confine themselves to one zone of climate or the other, though they may not attain equal dimensions under both these circumstances. The principal individuals among them are the following :—The deodar, the blue pine, the two firs, the birch, the alder, the walnut, *Celtis australis* and the yew. Among the fruit trees, the apricot, the peach, the pomegranate, the pears, as also the Spanish chestnut may be mentioned as occuring both above and below Wangtoo.

Climbers are generally absent above Karcham, and ferns and grasses are scarce ; while amongst the shrubs some varieties of Indigofera are present.

As we penetrate further on into the dry region the number of already few species begins to decrease. Thus the yew disappears at Baring, the olive and the alder both vanish at Purbani, the two first hardly extend as far as Rispa, the deodar does not go further than Morung, while the only trees we find at Neysing are the birch, the edible pine, the apricot and the blue pine ; the last named tree is of course either very small or not unfrequently mere shrub. Thus, we see that some trees cannot exist without excessive moisture ; such are the Rhododendron, Andromeda, grey oak, &c. ; while there are others which extend to the vicinity of the dry zone and there disappear ; such as the horse chestnut, box and *Pinus longifolia.*

Again, there are some species which would hardly be found except in localities where the annual rainfall falls below 18 inches ; such as Q. Ilex and the Pencil Cedar, while there are still some which would grow both in the dry as well as in the moist climate. Deodar is one of such trees.

Again, some species belonging to the last class of trees grow equally well under both climates. For instance, the apricot starts below Simla, and extends far in the interior in the arid zone, while there are others among them which show a preference for either of the two climates. The blue pine may be mentioned as representing such trees. This pine which is very commonly found in Kulu, and extends over a very wide-spread area in the Nogli and the Ganwi valleys in Bashahr, and also forms extensive forests in the moist climate below Wangtoo, although it extends far to the vicinity of the arid zone, where the deodar does not approach it, is generally sparingly found in the dry zone of climate in the Spoo

Valley. I am inclined to believe that the real region of distribution of this pine is in the moist climate.

In the dry region above Karcham the deodar is found either almost pure or mixed with the edible pine, where the blue pine is sometimes either rare or quite absent.

The scarcity of this pine in such forests may be due to some other causes as well, the principal cause among which may be mentioned the soil.

As a rule the upper portion of the hills occupying the Spoo Valley holds very little soil, and generally remains under snow for the greatest part of the year. The lower slopes are of course in many places clothed with forest growth. Viewed from a distance the soil of these forest-clad areas looks more like that of the abandoned bed of a river than anything else. It is free as flour, and is generally very stony with a large admixture of sand, and contains a large quantity of mica as well. It seems to have been formed mostly by the distintegration of the crystalline rocks occupying the upper summits of these hills, and as a natural consequence therefore it follows that the soil of these localities is as dry as the climate itself.

To such dry climate and dry soil conditions the edible pine adapts itself very wonderfully. This pine is satisfied with the very poorest soil, and sometimes it requires little, or I may say, no soil at all. Hardly any fissures in the rocks remain unoccupied by this three-needled pine of the dry climate. In this one particular it may be said to out-do its sister pine of the moist climate, which it so closely resembles in all its habits.

Amongst other trees, which are sometimes found mixed with this pine under such circumstances may be mentioned Q. Ilex and the small leaved ash.

In such forests the deodar eventually gets in. The pine fosters it when the cedar is young, and simply disappears when it is no longer required.

To such process may be attributed the existence of almost pure deodar forests at Ralli, Tangling, Powari and other similarly situated localities in the Spoo Valley.

But the Blue pine refuses to persist under cover over head. The natural conditions, as regards both soil and climate, are also far from being favorable for the natural growth of this pine in the unshaded areas. Consequently, it is generally sparingly found in this valley. In places, however, where the soil is comparatively moist the blue pine is not much wanting; as an instance of such a type of forests may be mentioned the Mehbar and the Purbani forests of the dry zone of climate where fine specimens of it are present.

It may be true to some extent that both the climate and the soil account for the rareness of the blue pine in the Spoo Valley; but it is certain that under a more favorable climate the tree would have sooner occupied such a poor soil than any other species. I believe, therefore, that the real home of this pine is in the moist climate.

Should it ever be desired to introduce deodar in the above localities by some artificial means, it should never be attempted in places where the edible pine itself, or some of its companions, are not present. For instance, if we ever try to grow deodar in the Tangling or the Powari forests, where the rainfall during the monsoon seasons is almost *nil*, where not a single drop of water is present in the soil, and where the soil is as poor as it can possibly be, we should always, under such circumstances, use the edible pine as a nurse for the young plants of the cedar. Our all attempts to raise the deodar otherwise are sure to result in failure.

Similarly marked difference exists between the fauna of the moist and dry regions in this district. I believe, therefore, that a few words about these denizens of our forests may not be without some interest. The baboon, the barking-deer, the '*eemu*,' are quite absent above Wangtoo, where these animals are replaced by the sheep and the Ibex.

The little hardy monkey of the plains is not uncommon above Wangtoo, but the numerous pheasants of the moist zone are generally scarce, if not quite absent. On the other hand, the snow-pheasant, which we seldom find anywhere below Wangtoo, is not rare in the dry zone of climate.

The Chamois goat is also very sparingly found above Karcham, but the Thiar (the Kirth of Kulu) does not confine itself to one zone of the climate or the other, though it is seldom found far up in the valley. The musk deer is generally more commonly found in the dry zone.

Among beasts of prey the common leopard is generally sparingly met with above Karcham, while higher up in the valley the snow-leopard replaces it. The black bear is not so common in the dry zone as it is in the moist region, but the brown bear is not wanting above Karcham. Similar differences occur among the domestic animals of these two different zones.

Thus we see that climate is the most powerful element which regulates all important changes in the forests of this region.

KAILAS,

MIAN MOTI SINGH.

The 20th April 1894.

Note on the Occasional Formation of Pseudo-Autumnal Zones of Wood.

In Hartig's "*Anatomie und Physiologie der Pflanzen*," which I am now engaged in translating into English, the following passage occurs at page 261 :—

"Throughout the tropics many ligneous plants exhibit no 'definite annual rings because their cambial activity is never 'interrupted. Differences in the structure of the woody tissue, occa- 'sioned by changes in the temperature and in the humidity of the 'atmosphere, can still occur without indicating any definite limit as 'to the quantity of wood produced in each year. Other trees 'within the tropics, however, plainly exhibit annular rings, owing 'to the fact that at the commencement of the dry period a cessa- 'tion of vegetation takes place, which resembles the approach of 'winter in the temperate zones."

In the above passage a clear indication is given of the nature and cause of the occasional occurrence of what seem to be two annual rings during one season of vegetation. Thus, for example, during the hill tour of the students of the Forest School in the Jaunsar division at the present time, in counting the annual rings of deodar (*Cedrus deodara*) trees it is sometimes noticeable (*e. g.*, at Deota, elevation about 8,500 ft.) that a close autumn-like zone of dense tissue is to be found about the middle of the annual layer,—a zone that might easily be mistaken for an annual ring.

The explanation appears simple. During the winter months even the evergreen conifers do not *grow*, they merely transpire through their foliage. With the advent of warmer weather in spring and the stimulation of the root-system, owing to the rise of temperature in the soil, the active period of vegetation is entered upon. At first it is feeble, and during this stage a portion of the reserve nutrients stored up in the form of starch is re-transformed into grape-sugar and utilised for various constructive and expansive purposes ($C_6 H_{12} O_5 + O$ becomes re-converted into $C_6 H_{12} O_6$). But with the gradual increase in atmospheric temperature the energy of growth becomes enhanced, and during the latter half of April, throughout May, and until the advent of the monsoon rains at the end of June, or the beginning of July, the vegetative activity is decidedly great. In consequence of the bright sunshine and the high temperature the woody-fibrous tissue is rapidly developed, the cells expanding considerably so as to form a broad spring zone.

With the arrival of the rains, however, the vegetative energy receives a check owing to the decrease in the temperature, and to the fact that the humidity of the air approaches the point of saturation. Combined with these there must also be a decrease in the intensity of the rays of light ; but this may not be, and probably is not, so great as to interfere to any appreciable extent with the process of assimilation. In consequence of the air being saturated with moisture during July and August the normal process of transpiration is directly interfered with. Despite the fact that, in order to stimulate transpiration, the stomata become enlarged automatically with any increase in the relative humidity if the air—just in the same way as they contract during very hot and dry weather, so as to decrease the rate of transpiration—it stands to reason that their task can only be very incompletely fulfilled when the whole of the woodland air has reached almost the limit of humidity, the point of saturation. With transpiration thus checked, assimilation cannot proceed as actively as was the case during the warm, dry months of April, May, and June; hence the cells of the wood formed during the two wet months of July and August expand less during the process of formation, and assume a dense appearance, closely resembling the true autumnal zone of the annual ring.

It will of course be apparent that, with this simultaneous fall in atmospheric temperature and diminution of vegetative activity, the *bark-pressure* will become increased, whilst the *counter-pressure* from within, *i.e.*, the expansive power of the cambial-cells engaged in the formation of new woody-fibrous tissue, will at the same time become weaker; and these conditions will considerably affect the size attained by the new cells in process of formation during the two wettest and coolest months of the S. W. monsoon season. Whenever the bark-pressure from without exceeds the counter-pressure from within, the formation of a pseudo-autumnal zone must take place; but when the opposite pressures are almost equal no such distinct line of demarcation need necessarily be visible. This would explain the fact that such pseudo-autumnal zones do not invariably run all round the periphery of the stem.

With the cessation of the heavy rains the relative humidity of the atmosphere decreases, and the temperature again increases considerably, so that during September and the early part of October there is a renewal of very active assimilation and of wider extension of the cells during the process of development. That is to say, after a dense pseudo-autumnal zone has been formed in July and August there follows a large-celled zone which appears, by contrast, to be a new layer of spring wood. During the autumn months, however, the true zone of autumn wood is produced normally, which plainly indicates the termination of active vegetation for the season, and shows that the tree has entered into the dormant period of the year.

In the Chir (*Pinus longifolia*) tracts of Jaunsar an analogous cessation of active growth during the wet and comparatively cold months of July and August makes itself felt with regard to the resin-tapping operations. The latter begin in the early part of May when once vegetative energy has become active. A good flow of resin, increasing with the temperature, continues till the air becomes cold and saturated with moisture in July. During July and August the result of this climatic change is that the outflow of resin is practically *nil*. But it recommences with the return of brighter sunshine, great warmth, and diminished relative humidity of the air in September, after which it continues declining gradually, till the close of active vegetation for the year.

Now, resin may be produced in one of three ways, *viz* :—

(1) By transformation of the reserves of starch prepared and stored up during the more energetic period of growth;

(2) By transformation of cellulose through the absorption and fluidification of the cells contiguous to the resin-ducts; and

(3) In an indirect manner, by the destructive action of fungi permeating the woody-fibrous tissue,—

And as the *normal production* of resin is that indicated under (1), it therefore follows that the stoppage of the outflow of resin during July and August may reasonably be regarded as a direct consequence of the altered climatic conditions and of the interference, due thereto, with the normal processess of transpiration, assimilation, elaboration of sap, conversion of grape sugar $C_6 H_{12}O_6$ into reserves of starch $C_6 H_{12}O_5$ and transformation of a portion of these latter into the resin containing oil of turpentine $C_{10} H_{16}$ and colophony.

In connection with the above it may be anticipated that an examination of sections of the Chir Pine will likewise exhibit the pseudo-autumnal zones, previously referred to as occurring occasionally in the Deodar. Up till the present, however, no investigations have been made with regard to this subject.

The phenomenon of the formation of pseudo-autumnal zones during the summer months does not of necessity recur every year. On the contrary, from my examination of sections of Deodar grown in the Jaunsar highlands, their formation appears to be only of unusual occurrence. They will only be formed during years of excessively heavy rainfall in July and August, with relative humidity very near the point of saturation, and with an unusual decrease in the number of hours of sunshine and the intensity of the rays of light. It *may* be possible to count back, on the Deodar sections obtained during the present tour, in order to fix the years during which pseudo-autumnal zones have been formed, and then to compare these dates with the general meteorological returns for North-Western India. But it is impossible to compare any dates thus fixed with actual rainfall and temperature returns of the exact locality where the trees were grown, for such meteorological data do not exist. The majority of the forest trees in different parts of India are apparently able to carry on the vital processes without thus registering a silent record of the changing climate; hence, wherever the pseudo-autumnal zones are discernible, this merely proves a less accommodative power in the given species of tree.

In the case of Sal (*Shorea robusta*) the annual rings of the mature wood are so indistinct that it is difficult to count them at all; but it is stated—a statement which I am not yet able either to confirm or to dispute—that young stool-shoots of this tree thrown out as coppice at Lakarkot on the Southern side of the Siwaliks (Saharanpur division), and known to be of a certain age, have apparently a larger number of dense (autumnal and pseudo-autumnal) zones of wood than corresponds with the number of years indicating their age. If this be the case, then the formation of these *pseudo-autumnal* zones must in all probability be ascribed to the climatic changes previously adverted to as occurring in July and August. The elevation of the Lakarkot coppice is about 1,500 feet, and the southern slopes of the Siwaliks receive the full burst of the monsoon, so that these climatic changes with regard to rainfall, temperature, humidity, duration of sunshine, and intensity of light will all be much more emphasised and strongly marked than if the forest growth were situated on the plains of India at a lower elevation, or even if it were on the northern slopes of the Siwaliks and at a somewhat higher elevation.

It has been asserted that the Teak tree sometimes exhibits a number of concentric zones of woody tissue exceeding the number of years in the age that the poles are accurately known to have attained. In thinnings conducted throughout many of the Teak plantations of lower Burma I have never met with such a case. But it seems to me that if they can be proved, a very plausible explanation may easily be given.

In a former number of the *Indian Forester* I pointed out that the Teak plantations of lower Burma are occasionally liable to be almost totally defoliated during May by the caterpillar of an insect which seemed to me species of Tortrix (*Tortrix Tectonae?*), but which, as was pointed out by Major Bingham subsequently, really are two insects, *Hyblœa puera* and *Paliga damastesalis*. After a period of defoliation and dormancy, extending from about the beginning of February till about the end of March, the Teak flushes its spring foliage. In the hot day air of Burma during April and the early part of May the process of active vegetation is extremely energetic; but, during years when the above caterpillars commit their ravages, the trees are practically stripped of their foliage before the end of May, and remain in a leafless condition till the summer flush of foliage comes out in July. Whilst the larvæ are feeding in countless swarms the normal processes of growth *must* be very seriously interfered with; consequently the formation of a pseudo-autumnal zone of woody-fibrous tissue *may* be the result. Whether such a result actually occurs can easily be tested by examinations of the annual rings during the next thinnings, and by finding out from the plantation journal if any bad attacks of caterpillars took place during the years in which pseudo-zones appear to have been produced.

That such pseudo-autumnal zones of woody fibrous tissue are not infrequent in the case of many Indian trees seems to admit of no doubt. And although it has no direct bearing on forestry, yet the matter is of much more than merely passing interest from a physiological point of view : hence it might be advantagous if men serving in different parts of India would kindly give their brother officers the benefit of any observations and deductions they may have made on the subject.

Camp Deota, Jaunsar J. NISBET.
19th May, 1894

The Gutta-percha Industry.

(*From the "Revue des Eaux et Forêts," extract from "Le Bois" of 10th January* 1894.)

Although it is not a product of the forests of Europe, with which the following article deals, yet it is a matter of considerable interest to follow the course of a most curious industry, which is closely connected with electricity and sylviculture. It is well known that gutta-percha is an indispensable article in electrical engineering, as it is the only insulating substance which can be used as a protective covering for conducting wires where in contact with other objects. All endeavours to replace gutta-percha for this purpose have failed.

In 1889, its price was 9 francs the kilogramme, in 1890 it reached 13 francs, and in 1891 17 francs. To-day the price is still higher, and it is steadily increasing

Gutta-percha is almost exclusively obtained from Malaya, it is the sap of the *Isonandra Gutta*, a large tree which is fairly abundant in that region. The tree does not produce gutta-percha until it is full grown, *i. e.*, after about 30 to 35 years. Its height is then as much as 100 feet and diameter about 3 feet on an average.

The mode of extracting the gutta-percha as practised by the natives is very simple. The tree is first felled and allowed to remain for some time, then a strip of bark is cut off longitudinally, and from this cut the gutta-percha slowly flows. Tapping of standing trees has been tried, as is done in the collection of resin, in order to prolong the period of production, but without success, the sap refuses to flow until after the tree is dead.

The material obtained as above is in a more or less pure state, but from the natives it passes into the hands of the Chinese, who mix various other substances with it in order to increase the weight, and it is only available for use after it has further passed through the hands of a series of traders whose business it is to boil it and increase the volume at the expense of the quality. As a result of this, for some years past the quality of the gutta-percha commerce has been steadily deteriorating, and to obtain the same effect a large and larger quantity has to be used.

The method of extractions employed by the Malays presents another serious drawback as regards the future; and this is that as the trees are felled just at the time when they are becoming capable of producing seed, reproduction is prevented, and the forests are thus being rapidly depopulated. Attempts have been made to acclimatize the gutta-percha tree in other countries, and more particularly in the French colonies, and there are doubtless in the Indo-Chinese colonies, Madagascar, and perhaps even in Algeria, large tracts of land where the condition would be suitable for the growth of this tree, resembling as they do in most points the conditions which obtain in its native country. These endeavours are praiseworthy and deserving of encouragement, but they do not, nevertheless, provide for the urgent requirements of the present, for, as mentioned above, it requires 30 years for the *Isonandra Gutta* to attain that degree of maturity necessary for the production of gutta-percha; and however desirable it may be to provide for future requirements, the first thing to be done is to assure the present supply.

For this purpose, experts were sent from France to Malaya to study the question from an industrial point of view. These have recently returned; and from the information given in the last bulletin of the Society for the Encouragement of National Industries it appears that a solution is about to be arrived at. It was noticed that the flow of gutta-percha was obtained by allowing the felled tree to continue its vegetative functions for a time, so far as the performance of these functions is possible by the aid of the leaves which are not removed from the stem.

This fact suggested the possibility of the gutta-percha, which distils from the bark, originating, in the first instance, in the leaves themselves, and consequently the possibility of obtaining the gutta-percha direct from the leaves without felling the tree. Experiments have proved the correctness of this supposition. Both dry and green leaves have been submitted to chemical treatment with a view to separating out any gutta-percha which they might obtain, with the result that by a comparatively easy and cheap process a yield of 9% has been obtained.

The leaves of one tree entirely defoliated give as much as 1,000 to 1,100 grammes of gutta-percha, whereas the tree itself only yields 265 to 270 grammes. Supposing that not more than half the leaf cover is removed, the other half being left to support the growth of the tree, this will still give a yield double of that hitherto obtained. The product thus obtained is accepted by importers at the same rate as the old or original article, and apparently for commercial purposes the two are identical. Investigation is still going on, and leaves are being received from different quarters to be tested in the laboratories, so that a definite result should soon be obtained, and if the conclusions hitherto arrived at are thereby confirmed, it is certain that the price of gutta-percha will soon begin to fall rapidly.

A. F. G.

II.—CORRESPONDENCE.

Reduction of the Imperial Forest Service.

SIR,

In a recent issue of the *Forester* (April 1894) a correspondent expresses concern at the impending absorption of an appointment of Deputy Conservator on the Central Provinces—Punjab List of officers, in order to provide for a supernumerary Extra-Deputy Conservatorship which has recently been filled up on that list. The last published official list of officers does not make clear the facts of the case, which are as follows:—The appointment of Deputy Conservator, 4th grade, will be absorbed *only* when a vacancy in that grade occurs, to which the officer recently transferred to the Provincial Service might, by priority of claim, have been appointed had he remained on the Indian Forest Service list. An examination of the previous list should convince officers of the Indian Forest Service that their interests cannot be prejudicially affected by the issue of these orders. As, however, apprehension exists, I shall feel obliged by your inserting this letter in an early number of the *Forester*.

B. RIBBENTROP.

Pension Rules of Forest Officers.

DEAR SIR,

In the last Coopers Hill Prospectus it is laid down, that the more favourable pension rules have recently been extended to Secretary of State's forest men, and that a forest officer, who puts in 7 year's approved service as *Head of the Department* may therefore get an extra Rs. 1,000 a year pension. I cannot find that these provisions have been added to the Civil Service Regulations, and shall be glad to know if the Government of India has embodied them in any Resolution. Presumably, all the rules in Chapter XXIX of the C. S. Regulations will apply, and under article 714 of that Chapter all Conservators of 3 year's standing would be entitled to the extra Rs. 1,000 pension, and not merely the "Head of the Department—"a term, I take it, which refers only to the Inspector-General of Forests.

J. W. O.

III.-OFFICIAL PAPERS & INTELLIGENCE.

Grass-farming in Coimbatore.

Attention having been drawn to the operations of the Commissariat Department in Northern India in the matter of the growth of grass to supply the requirements of Military departments, chiefly by conserving wild land, it was considered advisable to obtain a full report on the system followed by private stock owners in the Coimbatore district in the laying down and management of permanent pastures. The report has been prepared by Mr. C. K. Subba Row, Sub-Assistant Director of Agriculture, and is given below. It may, however, not be out of place to quote here the following references to the custom and allied matters extracted from Mr. Nicholson's Manual of the Coimbatore District. He remarks that "a marked feature (of the agriculture practice) of 'much of the district is the fencing, which is almost peculiar to the 'Kongu country ; it is found over most of Coimbatore, in parts of 'Salem, especially near Coimbatore, and in the Palni taluk of 'Madura. The habit of breeding large herds of cattle, the high 'winds, and the absence of any general custom of exchanging lands, 'probably induced this practice. From time immemorial large 'fields have been well fenced either with mullu-kiluvei (*Balsamo-'dendron Berryi*), something like a strong English bull-fincher, or 'with various species of Euphorbia and Cactus, including prickly 'pear. The practice of fencing is very valuable, cattle trespass be-'ing comparatively rare, cattle and crops protected, boundaries 'respected, large quantities of fuel supplied, and protection given 'to growing trees." The practice allows of the growth of pasture, regarding which he says :—

'This all-important subject receives little attention, though 'more than has been supposed. In taluks, such as Dhárápuram and 'Karúr, many fields are permanent pastures, either natural or sown. 'The fields, though stony, afford a good deal of pasture between 'June and February, but very little is to be found during the hot 'interval, and it is this trying break that, where forests and hills 'are not available, prevents cattle from thriving as they might ; 'disease also frequently breaks out after the first rains, when the 'sudden growth of grass is greedily devoured. The herbage is 'coarse, wiry and tussocky, and there is no sward as in English 'pastures. Artificial pastures are comparatively rare, but in some

‘taluks, notably the above two, the practice of ploughing and sow-
‘ing lands for pasture is practised. Hariali (*Cynodon Dactylon*)
‘and an indigenous grass called kolei-kattei are sown, the latter
‘most frequently; it is a very tall wiry grass, running rather to
‘tussocks, so that a Coimbatore pasture little resembles those of
‘England. It gives good feeding to judge by the prices paid.
‘The lands are ploughed in the hot-weather rains and grass seed
‘sown either by itself or mixed with cholum, gingelly, &c; if
‘the north-east monsoon is good, cattle are turned in to graze in
‘the following January, nine months after sowing; they graze
‘through the hot weather till the early rains of the south-west
‘monsoon. Grass is occasionally sown with gram in September,
‘sometimes with kambu in July. The land is usually manured
‘when the grass is sown, and thereafter the cattle grazing on it
‘for several months in the year manure it. The pasture lasts for
‘many years, and is then again ploughed and resown, or broken
‘up for crops. Pasture growing is often a better speculation than
‘crop growing, as a field of 8 or 10 acres will be grazed by as many
‘cattle at from 4 annas to 1 rupee per mouth for several months.
‘In addition to the grasses sown (usually hariali and kolei-kattei),
‘other grasses, such as vennei, mattankáy (*Cynosurus egyptiaca*),
‘ilei (*Panicum marginatum*), sourikodi, and naripayathán-kodi
‘grow spontaneously. No attempt is made to adapt the soil or to
‘use other grasses.

‘It has been supposed that the district once abounded in good
‘grass lands, that these have disappeared and been brought under
‘cultivation, and that this, especially as regards the best pastures,
‘was brought about by a change in the assessment some years ago,
‘by which ryots, who had been accustomed to hold pasture lands on
‘puttah at one-fourth of the assessment, were permitted to do so only
‘if no other person was willing to take up the land for arable cul-
‘ture at the full rent

‘It must be clearly understood that the grass lands of which
‘the ryots bemoaned the loss, and ‘the jungle’ supposed to have
‘disappeared, are one and the same, *viz.*, the poorest dry lands
‘wholly untilled and occupied and producing on their stony and
‘sterile surface a few straggling and stunted bushes, and a little
‘coarse, hardy grass. The better grass lands held ancestrally by
‘the ryots have been broken up by their owners at their own plea-
‘sure and for their own profit, and the increase in occupied area
‘has, on a comparison of existing facts with Mr. Hodgson’s descrip-
‘tion, led to a great increase in tree growth.”

The grass most commonly grown in the district is the *Kolei-kattei*, which the Government Botanist identified in 1887 as being the *Pennisetum cenchroides, Rich.* Regarding this grass Mr. Duthie, in the Dictionary of the Economic Products of India, says that it is “a most excellent fodder grass, thriving best where the
‘soil is sandy, in the Multan district it is considered to be the best
‘grass to give to milch cows. Would probably repay cultivation.”

Mr. Subba Row's report on the system of grass-growing in the district is as follows :—

"The origin of the name '*kolei-kattei*' as applied to the grass 'is obscure. '*Kolei-kattei*' literally means a preparation consisting 'of fried cocoanut scrapings or gingelly mixed with jaggery, en- 'closed in a sac of rice flour and steamed, which is particularly 'acceptable to *Ganésa.* No part of the grass, however, presents 'any likeness to *kolei-kattei.* Some ryots were of opinion that the 'name of the grass is really *kolukkatti*, which means 'proof against 'the ploughshare,' as the grass is not liable to be exterminated by 'any number of ploughings, provided the roots are not gathered off.

'Owing to the long-continued drought, the grass was met with 'in tussocks, which were quite parched up. In Palayakottai, how- 'ever, I saw it in a green state, about 1 foot high, amidst a cholum 'crop which had been manured with sheep manure.

'The grass has what is called a creeping stem with suppress- 'ed internodes, the stalks above ground being really branches. 'Each plant tillers at every joint, corresponding to each leaf bud, 'where a separate set of roots is given off, making in all from 50 to '100 adventitious roots when well grown. The plant may be trans- 'planted with success at any stage of growth. The Palayakottai 'Pattagar says that even when the grass has ripened its seed, it may 'be transplanted several hours after being pulled out, provided the 'roots are kept moist. The grass is stimulated to comparatively good 'and rapid growth by showers of rain too light to have any effect 'on other grasses. Though the grass may apparently die during a 'long-continued drought, it is revived by one smart shower. The 'vitality and propagating power of the grass are thus remarkable. 'The roots of the grass are very short, being scarcely three inches 'long even in very old pastures. The grass may, therefore, be 'easily cleared off the land by ploughing a few times and gathering 'off the roots.

'The great preponderance of dry land and the scarcity of 'hills are causes, so far as I can observe, of a large proportion of the 'occupied area being left waste for pasture and of large areas being 'cultivated with *kolei-kattei* grass, and of cholum and narippayir '(*Phaseolus trilobus*) being cultivated for fodder exclusively.

'Grey loamy soil, which, I believe, is rich in lime, is consider- 'ed the best for *kolei-kattei* grass. Next comes red loamy or sandy 'soil with fine particles. Black cotton soils, which are com- 'paratively friable, and soils derived from the disintegration of 'masses of agglomerated limestone, come next. Soils on old village 'sites, or fields which, on account of their close proximity to villages, 'are used by villagers as public latrines, are also very good. It is 'desirable that the land for *kolei-kattei* grass should have a gentle 'slope, so that rain water may drain off easily. If the slope of the 'land be not gentle enough, high bunds, like those of tanks, are 'raised so as to retain rain-water sufficiently long on the land and 'then let it off. Bunds constructed for this purpose (not only on 'account of the grass, but also on account of other field crops) are 'such a common feature in the Kángyam division as to lead to the 'supposition that tanks are very numerous there, until it is seen 'that the bunds have no sluices or waste weirs, and that there are 'no crop irrigated under them. I observed that on the low lying 'strip of land close to the bunds not a blade of *kolei-kattei* was to 'be found, stagnant water being particularly injurious to this grass. 'The grass is said to be spoiled if water stand on it for more 'than a day. I saw that hariali grass and *khanampul* had super- 'seded *kolei-kattei* in the hollow places adjoining tank bunds. Stiff 'soil are unsuited to *kolei-kattei*.

'The grass is seldom sown by itself. As a rule, it is sown on 'the same land as and immediately after (1) gingelly, (2) cholum- 'or (3) cumbu is sown, or (4) amidst a crop of *nadam* cotton in the 'last year of its growth. There are two seasons for sowing *kolei- 'kattei* grass, *viz*., the *kar* (from April to June) and the *paruvum* '(from August to October). Gingelly is said to be the best crop 'with which to sow the grass, and the *kar* season is preferable for 'sowing it. It is undersirable to stir the soil till three years after 'sowing *kolei-kattei* grass, and, as gingelly needs no interculture in 'the *kar* season, the grass is sown in the majority of cases 'immediately after gingelly. As a rule, the land on which the 'grass is sown is manured with sheep manure. Next to gingelly, 'cholum is the crop with which the ryots prefer to sow the 'grass. This may be done either in the *kar* or in the *paruvum* 'season. The grass gets a far better start and grows much better if 'sown in the *kar* than if sown in the *paruvum* season, provided there 'be good rainfall in that season. But, as the *kar* rainfall is pre- 'carious, the grass is sown in most cases in the *paruvum* with 'cholum or more rarely with cumbu. In the latter case, it is only 'after the cumbu crop has been bullock-hoed that the grass seed is 'sown, interculture being essential for cumbu and destructive of the 'young grass. The grass seed is invariably sown on the surface, 'and the soil is not stirred afterwards, nor is the seed covered in. 'The seed should not be more than a year old.

'If the soil be moist enough, the seed germinates about six 'days after being sown. A shower of rain enables the grass to 'secure good hold on the soil. The grass is said to be benefited 'by the wind which blows pretty strongly from May to August, as 'it heaps up very fine soil against the stalks, which affords not only 'additional food to the plants, but also shelter to the roots. Two 'months after sowing, the grass begins to flower, and it is then as 'high as a man's waist. The Pattagar says that he has known the 'grass to attain a man's height under very favorable circumstances 'of soil and rainfall. About three months after sowing the grass 'seeds.

'As a rule, cattle are not let in to graze on the new fields till 'at least six months after sowing. If seed be sown in May or June, 'the grass will be fit for grazing by December, and if it be sown in 'July or August about February. In some cases cattle are allowed 'to graze immediately after the ears ripen and shed their seed; 'that is about four months after sowing. If cattle be let in too soon 'the plants may be pulled up by the roots on being grazed. Very 'great care is taken during the first year that neither sheep, goats, 'nor ponies have access to the grass, as these animals bite the grass 'close to the ground and thus kill it.

'*Kolei-kattei* grass-land is securely fenced with mullu-kiluvei '(*Balsamodendron Berryi*) against the trespass of cattle and sheep, 'which would otherwise keep the grass down. The size of an enclosure is never less than about 4 acres. On large estates where 'large numbers of stock of different kinds are kept, as at Palayakottai, the size of an enclosure may be 100 to 150 acres. Once in 'three years the fences are cut, when they present large gaps below, 'and the cuttings are in most cases planted close to the old fence so 'as to make it more dense.

'If the grass be sown in the *kar* season, cattle are let in to 'graze, as said before, about December, and go on grazing till 'March. They are then kept off the land till about a month after 'the grass has been refreshed by the next *kar* rains, and are then 'allowed to graze till rain falls in July or August. For about a 'month afterwards, the cattle are kept off the pasture, and then 'they go on grazing till even February or March. If there is more 'grass than the cattle can eat, it is cut before it becomes over-ripe, 'that is, soon after flowering. Grazing is generally available for 'cattle for about eight or nine months in the year from the 'second year forward. On large estates, like that of the Palayakottai Pattagar, breeding bulls and working cattle graze in separate 'enclosures, so that the vigorous and spirited bulls may not tease 'and injure the bullocks. Separated enclosures are also allotted to 'carrying and to empty cows; with the latter breeding bulls are 'allowed to run. The Palayakottai Pattagar says that two *vallams* 'or about 7½ acres of *kolei-kattei* grass afford sufficient pasture for 'a pair of cattle for about nine months in the year, *viz.*, for about 'three months in the *kar* season and about six months after the '*paruvum* rains have set in, and that the cattle would require to 'be fed with cholum straw or other fodder during the remainder of 'the year.

'Ordinarily, cattle are not left on pasture ground during the 'night, for fear of thieves and snakes. Young stock and cows generally graze from sunrise till sunset. Under such circumstances, 'a *vallam* (3·82 acres) of excellent land will support in good seasons '20 heads of cattle for 30 days on the whole during the year. So, 'about 2½ acres of good pasture in good seasons will give enough 'grazing for each head of cattle throughout the year.

'As said before, young stock and cows graze generally from 'sunrise till sunset. But from January to March they are turned out to graze at 3 or 4 A.M., for the grass, being then wanting in moisture, is best eaten when it is wet with dew, and in the hot season also they are sent out to graze very early ; for, during the heat of the day, cattle leave off grazing and seek shelter under trees.

‘Sheep are only allowed to graze the stubbles left after the cattle. The stubbles are said to be about a span high. Stock of all kinds thrive best on tender grass which renders the skin glossy. Ponies prefer hariali grass and do not eat *kolei-kattei* grass unless it is tender. Cattle thrive on *kolei-kattei* grass better in the *kar* season than in *paruvum*, although grass may be abundant in the latter season ; for they are worried by seekadi, an insect pest, and also do not drink water freely in *paruvum*.

‘Under average circumstances *kolei-kattei* grass appears to be rented at about Rs. 15 per *vallam* of 3·82 acres, the owner paying the assessment, which is about 12 annas per acre on the average. There is thus a profit of about Rs. 3 per acre.

‘At intervals of three or five years the grass land is ploughed immediately after a shower of rain at the end of the hot season, before the tussocks show signs of fresh growth. The furrows are ordinarily about four inches apart. The Palayakottai Pattagar says that he ploughs and *also cross-ploughs* his grass land at intervals of about five years, and that there is not the slightest danger of the grass being killed by close and repeated ploughing, unless moisture be wanting in the soil and rain hold off for long after the operation. When the grass has once matured its seed, no crop is usually sown on the land with the grass ; but I saw two extensive fields, sown with *kloei-kattei* grass years ago, cultivated with cholum this year, in Palayakottai. In one of the fields cholum was still standing, and on account of the tillage and the sheep manure which the land had received previous to cholum being sown, the grass was very luxuriant. This is very remarkable and interesting, considering the fact that nowhere else did *kolei-kattei* grass show any sign of life. Besides the tillage and the manure, the partial shelter afforded by the cholum plants accounts for the grass being in such comparatively good condition in these two fields. As a rule, the only manure which *kolei-kattei* grass gets is the dung of the stock grazing it. On very high ground consisting of very inferior soil, it is said to be desirable to remove the grass altogether after a lapse of 10 to 15 years, and to resow the land. The grass is seldom irrigated.

‘*Kolei-kattei* grass is sometimes cut and stocked. About three cuttings are obtained in the year. The yield per acre under favorable circumstances appears to be 200 to 250 bundles, 9 feet in girth, per annum. The average yield is not less than 100 bundles per acre, and this, as each bundle of green grass is estimated to weigh about 50 lb. = about 2¼ tons.

‘If land be simply left waste for a few years, grasses of various kinds grow upon it ; but a given area of such land does not

‘ support half as much stock during the year as an equal area under ‘ *kolei-kattei* grass. The ryots do not appear to leave any block of ‘ land permanently waste as a rule ; each field appearing to get two ‘ or three years rest in its turn. If a piece of land be once sown ‘ with *kolei-kattei* grass it is not advisable to bring it under cultiva‘ tion again in two or three years ; and, as the growth of the grass ‘ during the first year is not very good, there is no advantage in ‘ laying down the land under grass if it is to be cleared in a year ‘ or two. when it is well established.”

The Principal of the College of Agriculture states in a recent report on this grass that, after some twelve years' experience at Saidápet, it has been found one of the hardiest grown there, and that apparently, if it once takes root, it does not die out easily. Even in April and May, the driest months at Saidápet, the plot under the grass is well covered.

Regarding the growth of fodder crops grown as such, which is a subject allied to the above, Mr. Nicholson in his Manual remarks that it is “ rare, but the practice is known throughout ‘ the district and is occasionally followed. In the Kángyam divi‘ sion of Dhàrápuram, where the best cattle are still reared, there is ‘ a regular practice in February-March of growing either cholum ‘ (*Sorghum*) or cumbu (*Penuideum spicatum*) (chiefly the former) ‘ under well irrigation ; this is called adar cholum from its being ‘ sown closely so as to yield heavily, and is grown at any time that ‘ fodder may be wanted. It is cut down before earing and affords ‘ considerable provision during the hot weather. Fodder crops ‘ are not grown on dry land ; there is considerable pasture except ‘ in the hot weather, and as it is unusual to get rain sufficient ‘ even for ploughing from the end of December to 15th April, no ‘ such crops are possible except on garden lands. The ryot excuses ‘ himself from growing fodder by alleging, and with some reason, ‘ that, as his cholum fodder is little injured by growing to maturity, ‘ he grows cholum as grain crop rather than as a fodder crop for ‘ the double yield ; the expenses of well irrigation in the hot ‘ weather are considerable, and few could afford to lose the grain ‘ of the crop.” (*Bulletin 2, Madras Agricultural Department.*)

Poona College of Science Calendar for 1894.

The Forestry Class at the Poona College was started in 1879, and opened with 12 students, but the numbers appear to have fallen off later on. Only matriculates are admitted, and a certain number of scholarships are given yearly for competition. The course lasts 1 or 2 years, and the annual fee is Rs. 50, in which respect the College differs from Dehra Dún, where there are no fees.

There are now two classes, leading respectively to the Forester and Ranger grades of the Department.

The Forester class, under the Provisional Regulations, admits only candidates who are above 18 and under 23 years of age, and have previously worked for 400 days at least in the workshops of the College. At the end of the first year, the candidates are examined in (1) Arithmetic, (2) Mensuration, (3) Surveying with compass and chain and plotting, (4) Materials used in Construction, (5) Elementary Botany, (6) Forestry ; and apparently this is all, for the Calendar mentions no second year. Nor does there seem to be any out-door instruction or practical forest work at all. The Ranger's class is admitted after a competitive examination in (1) Mathematics (Arithmetic, Algebra and Euclid), (2) English composition and hand-writing, (3) Reading and writing in a vernacular ; the students pay Rs. 25 per term as fees ; and the course is completed in two years when the final examination is held. This examination is in the following subjects :—

(1) *Mathematics and Natural Philosophy*

Paper No. 1. Algebra and Euclid.
" " 2. Trigonometry and Mensuration.
" " 3. Natural Philosophy.

(2) *Experimental and Natural Science.*

Paper No. 1. Heat.
" " 2. Physical geography, Mineralogy & Geology.
" " 3. Inorganic Chemistry
" " 4. Structural Botany
" " 5. Systematic Botany (with a practical test in the filling in of schedules)

(3) *Civil Engineering.*

Paper No. 1. Surveying (with a practical test in the Survey of about half a square mile)
Paper No. 2. Roads and earth-work
" " 3. Buildings.

(4) *Forestry*

Paper No. 1. Sylviculture.
Paper No. 2. Organization of Forests.
" " 3. Forest law.

There seems to be no oral examination, and no teaching of the important subject of Forest Utilization.

We have given the above sketch because we have often been asked to say what we know of the Poona curriculum, and think it will be interesting. For details of the courses, we must refer our readers to the Calendar which will show them that the Forestry is apparently treated as a minor subject, and that Poona students are expected to be very learned in Inorganic Chemistry and Heat, and need know very little indeed of Geology and nothing of 'Soils.'

IV.—REVIEWS.

Indian Museum Notes Vol. III. No. 3.

The following information derived from these 'Notes' is of Forest interest

(1) The winged form of the Bamboo Aphis (*Oregma bambusæ*, Buckton) see Vol. XIX p. 192, has been discovered in Ceylon on the yellow-stemmed *Bambusa vulgaris*. It is almost quite black.

(2) The longicorn beetle, which has the peculiar habit of girdling the branches and twigs of the trees has been discovered. It proves to be *Sthenias grisator*, Fabr. The specimens were obtained by the Deputy Conservator of Forests in Coorg (the late Mr. Foster) on rose trees. The following is the account given :—

"An interesting longicorn was forwarded through the Madras 'Museum in November 1892, by the Collector of Kurnool, with 'the information that it had been noticed cutting rings of considerable depth and about an inch in diameter completely around the 'branches of a *Tabernaemontana alba* tree. The specimen has been 'identified through the kindness of Mr. C. Gahan, of the British 'Museum, as a female of the species *Sthenias grisator*, Fabr. 'Mr. Gahan notices that the male may be distinguished from the 'female by a small process projecting obliquely upwards from the 'base of each of the mandibles in front of the clypeus. He adds 'that the British Museum possesses a specimen taken more than 'thirty years ago near Coimbatore which bears a ticket with the 'following note—'gnaws the bark of shrubs and is very destructive.'

"The same species was subsequently forwarded to the Indian 'Museum in January 1893 through the Imperial Forest School. 'In this case it was obtained by the Deputy Conservator of Forests, 'Coorg, who wrote :—'These beetles cut off the stem clean in 'one night......Large rose trees are thus cut down and destroyed. 'It is incredible that a small insect like the one I send can do such 'damage, and I would not have believed it had I not seen their 'ravages myself.........I got them this morning from off the rose 'bushes they had destroyed. They attack the main stem and 'despise smaller branches.'

"The rose stems forwarded with the insects ranged from three 'quarters to half an inch in diameter, and were cut completely off 'with remarkable neatness. The parent insect no doubt girdles 'the shoot with a view to afterwards laying its eggs above the notch.

'The habit is one that has been noticed with other species of the 'same family, and exemplifies the fact that withering trees are the 'ones most frequented by longicorn borers, the supposition being 'that a vigorous flow of sap is liable to choke the larva in its 'burrow."

(3) The following information is given regarding teak-defoliators:—

"Both in 189, and 1892 damage was reported in the forests 'of the Hyderabad Assigned Districts by caterpillars which defoli-'ated the teak trees.

'The specimens, which were forwarded to the Museum through 'the Forest Department in 1891, could not be identified at the time, 'as they were immature. They were preserved, however, for fur-'ther investigation, and careful comparison with authenticated 'caterpillars since received from Burma shows that the insects in 'the two cases are identical. The species is the one referred to on 'page 94 of volume III of these *Notes* under the name of *Paliga* '*damastesalis*, Walker. According to a report furnished by the 'District Forest Officer of Berar, the insect appeared in the early 'part of September, but information has not been received upon 'the subject of the extent of the damage that was occasioned.

'In 1892 the insect was a different one. It proves, from the 'specimens forwarded to the Museum, to belong to the species '*Hyblœa puera*, Cramer. Injury commenced earlier, and a good 'deal of damage was done in the beginning of the rainy season. The 'attack is said to have been very severe in pure patches of teak, 'but was less noticed in areas where the forest was a mixed one. 'The trees that were attacked looked quite brown amongst the 'surrounding foliage, and ultimately lost their leaves, but a new 'flush of leaves soon appeared. When full fed the caterpillars were 'said to have let themselves down by silken strands and to have 'formed cocoons in the ground.

'The species *Hyblœa puera*, Cramer, has previously been 'recorded as attacking teak in Lower Burma, as well as in Dehra 'Dun, North-Western Provinces, and in the Kulsi plantation in 'Assam, so probably occurs throughout India."

(4) Another insect which was discovered by Mr. J. F. Bourdillon boring into teak trees in Travancore has proved to be a Bombyces moth, *Cossus Cadambœ*, Moore. The insect chiefly attacks softened unhealthy wood, not sound trees.

(5) A large cerambycid beetle, which has been discovered boring into *Farash*, *Sarin* and *Kikar* trees in the Punjab, proves to be *Neocerambyx holosericeus*, Fabr. It generally attacks the trunk near the ground, and the part affected is recognized by a swelling in the bark.

(6) A longicorn borer, found by the Conservator of Forests in Berar, boring into babul trees and doing great damage, has been identified as *Celosterna spinator*, Fabr.

An American Working Plan

In November last an Editorial article appeared in *Garden and Forest*, from which we extract the following :—

"The time has already arrived, or, at least, it cannot be far
‘distant, when timber-lands will be an inviting investment for those
‘who wish to keep their forests for permanent cropping. He does
‘not suggest the planting of forests from which the first returns
‘are distant from thirty to a hundred years, although tree-planting
‘by no means ought to be discouraged on the forestless prairies
‘and in the plains country. Nor does he advocate the purchase
‘of culled pieces of woodland from which the valuable timber has
‘already been cut. But, inasmuch as it is possible, even now,
‘to buy well-stocked virgin forest-lands which already contain
‘a full-grown crop, half of which is valuable and accessible to
‘large markets, for from $5,00 to $10,00 an acre, the more
‘rational method would be to take this ready-made crop and apply
‘to it systematic forestry. As the country has grown richer, the
‘rates of interest have declined, and if Government bonds, on
‘account of their safety and the ease with which the interest is
‘collected, bring less than four per cent., the compounding of
‘interest on forest-property, which is safe and increasing in value,
‘may justify us in making our estimates at a still lower figure.
‘The investor in such timber-land can at will draw interest, and
‘he can anticipate it by taking advantage of favourable market
‘conditions, and he can still have an investment capable of increas-
‘ing its yield, partly by the increased product under good manage-
‘ment, and partly on account of increased price for his product.
‘To enforce this view, Mr. Fernow states that during the last forty
‘years the price of wood has increased in Germany at the rate of
‘from one and a half to nearly three per cent. a year. In Prussia,
‘the price nearly doubled from the years 1830 to 1865, while
‘between 1850 to 1891 it rose from three cents to nearly five cents
‘a cubic foot for wood of all kinds and sizes. And since our
‘virgin forest-supplies are being consumed at a rate which exceeds
‘twice the capacity of the existing area to produce it, thrifty grow-
‘ing timber must surely increase in value. For long investments,
‘therefore, timber-lands, under good forest-management, may even
‘now be considered as equally profitable in the long run to timber-
‘lands which are bought for the purpose of culling out all that is
‘good and leaving the forest in a worse condition than it was
‘before."

In January 1894, there appeared in the same periodical, under the signature of Sir Dietrich Brandis, a confirmation of the above which we reproduce with pleasure :—

"I observe, in an editorial article of your issue for November
‘1st, that Mr. Fernow is quoted as recommending forest-lands under
‘regular management for long investments. This is an idea which

'I have long held. Many circumstances seem to me to co-'operate in this direction. These are:—

'(1) The low figure at which even untouched virgin forest-'land can be bought in certain places; (2) the steadily advancing 'price of timber; (3) the diminishing rate of interest; (4) the rise 'in the price of labor, which will be intensified by the restrictions 'placed upon immigration; (5) the growing desire to establish 'family property on a permanent basis.

'The increasing price of labor has already begun to make 'agriculture difficult, and it will become more so, except on virgin 'or exceedingly fertile soils. Forests require much less labor.

'All these facts tend to make it not unlikely that proprietors 'in some parts of the United States may eventually invest their 'money in forest-land, with a view, under regular management, 'of getting a moderate annual income, of steadily increasing the 'capital value of their estates and of eventually getting a large 'annual income. It seems to me that the man who first succeeds 'in setting the example in this respect, on a sufficiently large scale, 'will be the leader in what is destined to be a great movement."

Before the above had been read in India, we had received, for perusal, by the kindness of our Inspector General of Forests, a copy of a simple little working plan which had just been made by Mr. Gifford Pinchot, Consulting Forester (and, if we mistake not, a passed student of the Ecole Nationale Forestière at Nancy) for the Biltmore Forest in North Carolina. the property of Mr. George W. Vanderbilt, and this little work seems to point to the latter gentleman being the leader in such a movement as Sir D. Brandis refers to. From all we have heard and read, the dearth of timber and fuel is likely to be a very serious question in the United States before many years are out, and so it is a satisfaction that at least one proprietor has been found who is foreseeing enough to understand the value of a well-managed forest estate.

The Biltmore Estate lies on broken hilly land on both banks of the French Broad river, along which it stretches for about six miles, and occupies an area of 7,282 acres, of which 3,891 acres are woodland, constituting the Biltmore Forest. It is not regular in outline because it is interrupted by patches of cultivation. The rock is an ancient gneiss, with a considerable intermixture of pegmatitic quartz, and it readily disintegrates giving a rather stiff sandy loam soil, one which in spite of its depth is not very favourable to the growth of trees. The climate is temperate, the rainfall amounting to 43 inches yearly, while the temperature reaches its maximum of 99 degrees in July and its minimum of 6 degrees in December, and the relative humidity is least in May and greatest in January.

The trees which compose the forest are chiefly deciduous, and the chief of them is the White Oak (*Quercus alba*), after which came the black, scarlet and Spanish oaks (*Quercus tinctoria*, *Q. coccinea* and *Q. cuneata*). Then come the short-leaf pine (*Pinus echinata*), the chestnut (*Castanea sativa*), the hickory (*Hicoria* sp. sp.), the black gum (*Nyssa sylvatica*), the maple and the tulip tree (*Liriodendron tulipifera*); but their distribution has been much disturbed by human agency, the pine tending to encroach wherever a clearing exists.

Owing to previous bad treatment, the condition of much of the forest is poor, and thus the present condition of it comes under two heads: (1) where all ages are more or less completely present in all parts, and (2) where one age-class is distinctly predominant. In the former the *selection* system must be followed; in the latter in order to prepare the way for a working plan under high forest, *improvement cuttings* are prescribed, with exclusion of cattle, protection from fire, and complete rest to those parts where the crop is too old for planted trees to compete with it successfully. So far, the improvement cuttings have been successful; and after they have been completed it is proposed to work on the *Regular High Forest System* with a rotation of 150 years and as many sub-divisions. The number of compartments formed has been 92, and these are grouped in 3 blocks. For the first year's work there has been a deficit, which is expected to disappear later on.

An interesting addition to the estate is being made in the shape of an Arboretum of about 120 acres in the form of a strip 100 feet wide on either side of a 5 miles' drive, and in this it is intended to collect specimens of all the trees and shrubs that can be grown in the locality, collected from all the countries that can afford them, and in this way we believe India also has been indented on Such trees as are found to thrive are to be used in planting up about 1,000 acres of land which is at present unoccupied.

Mr. Pinchot's little working plan is profusely illustrated with excellent photographic prints of parts of the forest under management, and it is accompanied by a neat small map of the forest.

VI.—EXTRACTS, NOTES AND QUERIES.

Extraordinary Crop of Hirda fruit in Satara.

Mr. R. Fagan writes that in the past season, the crop of Hirda (*Terminalia Chebula*) on the Western Ghats in Satara has been in some ranges 50 per cent and in other 100 per cent over average. The general opinion is that the monsoon did not burst with violence, but came in gently at the time the fruit was setting, thus causing the increased crop. We should be glad to know if in other places the experience has been the same.

Comparative effects of lightning on different trees.

It is a well-known fact that lightning strikes some kinds of trees more than others. Thus, in America, oaks, ashes, white poplars, and elms are often struck, while beeches and walnuts very seldom suffer. Vines, cotton plants, and palms are peculiarly susceptible to lightning. There is also evidence to show that varieties of the same tree growing in different countries and climates differ in their immunity, probably owing to the quality of the wood and sap ; so that statistics for one region may not be reliable for another. M. Dimitre has continued his experiments on this subject by subjecting specimens of living wood of equal dimension in the direction of their fibres to the spark from a Holtz electrical machine, and finds that oak is easily penetrated by it, while black poplar, willow, and especially beech, are much more resisting. In all these cases the heartwood is the least conductive. In fact, the starchy trees, poor in oil, such as oak, poplar, willow, maple, elm, and ash, offer much less resistance to the spark than beeches, walnuts, birches, and limes, which are "fat" trees. Pines, which contain a good deal of oil in winter, but have little oil in summer, are much more resisting in one season than the other. In summer time the wood is as easily pierced by the spark as oakwood. and in winter as difficult to penetrate as beechwood. When the oil of beech and walnut wood is extracted by ether the spark easily goes through. The dead wood of starchy trees is more easily pierced than the living wood, a fact which militates against the common idea that sap conducts the discharge. The bark and foliage of trees are, according to M. Dimitre, bad conductors. The above observations agree in a general way with statistics of lightning strokes in Europe. Thus, in the forests of Lippe, from 1879 to 1885 and in 1890, there were 159 oaks, 59 pines, 21 beeches, and 21 other kinds of trees struck.—(*Indian Agriculturist*).

The strongest timber.

The strongest timber known is the "Bilian" or Borneo ironwood, whose breaking strength is 1·52 times greater than that of English oak. By long exposure it becomes of ebony blackness and immensely hard. (*Scientific American*).—Can anyone tell us what the 'Bilian' is ?

Obituary. C. C. Abbey.

It is with great regret that we announce the death of this promising young officer in the Oudh Forests, on the 19th May. Abbey only came out to India last year after a successful course at Cooper's Hill, from which he had passed out 2nd with a Fellowship. He was engaged on fire-protection work in Kheri and was riding along a 100 ft. fire-line when a Sàl tree, which had been girdled in the improvement fellings, fell upon him, killing both horse and rider. The accident was a most unprecedented one. His Conservator informs us that he had very favourably impressed him and his brother officers with his enthusiasm for his work, and that his death has caused great grief in his Circle. We are sure our readers will agree with us in deploring the sad accident which has lost us such a promising young officer.

VII.-TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

4th May 1894.

East India Teak.—The deliveries for the first four months of this year amount to 4,297 loads against 3,863 loads in the same period of 1893, but in the past April only to 729 loads against 1,092 loads for April 1893. The Dock Stock is very moderate, and there are many indications of improved special demands for this wood in the coming months. The floating supply is well disposed of some way ahead, but in the absence of general demand prices remain without more than a turn towards a higher level.

Rosewood.—Stocks are sufficient for present limited demand.

Satinwood.—Figury logs of good sizes would sell well, but there is no enquiry for small, plain wood.

Ebony—Is in rather better demand, and there is no stock.

PRICE CURRENT.

Indian Teak	per load	£10.	to £16
Rosewood	„ ton	£5.	to £8
Satinwood	per foot superfical	6d.	to 12d.
Ebony.	„ ton	£8.	to £15

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, May 1894.*)

Cardamoms,	per ℔.	2s.	to	2s.6d.
Croton seeds	per cwt.	20s.	to	27s.6d.
Cutch	,,	20s.	to	32s.
Gum Arabic, Madras	,,	15s.	to	35s.
Gum Kino	,,	£15	to	£18
India Rubber, Assam	per ℔.	1s.7d.	to	2s.3d.
,, Burma	,,	1s.7d.	to	1s.11d.
Myrabolams, Bombay	per cwt	8s.6d.	to	10s.6d.
,, ,,	,,	4s.	to	4s.9d.
,, Godavari	,,	6s. 3d.	to	7s.
Nux Vomica, good	,,	6s.	to	10s.
Orchella, Ceylon	,,	16s.	to	22s.
Redwood	per ton	£3.	to	£3 10s.
Sandalwood, logs	,,	£35	to	55
,, chips	,,	£9	to	30

THE
INDIAN FORESTER.

Vol. XX.] July, [No. 7

Notes on the tour of the Forest School students in the Western Dun and Saharanpur Siwaliks in 1894.

BY H. G. BILLSON.

On Monday, January 5th, the plains tour of the Junior Forest students was started by a visit to the boom at Dakpathar. The work here was in full swing, sleepers coming down regularly and in large numbers. Drawings were made of the boom sections, windlasses and tramway, and a full description of the boom and its working given to the students.

The boom itself has been previously described in this Journal, so it need not again be referred to except to say that it was in excellent working, and that the catching of the timber was being well and efficiently performed.

THE KALSI COPPICE WITH STANDARDS.

The forest lies on the outer spurs of the Himalaya around the town of Kalsi in the angle formed by the junction of the Tons and Jumna rivers, and abuts on its eastern side on the main road from Saharunpur to Chakrata. The area managed under this system forms a Working Circle of three blocks.

The first, or Haripur Block, consists of 18 compartments; the second, or Panjgaon Block, of 6 compartments; and the third, or Barabagh Block, of 4 compartments. Of these, six compartments lying in Haripur and Barabagh, of an aggregate area of 788 acres have been excluded from the coppice area which is, without this part, sufficient for the present demand. A part of this uncoppiced area being near Kalsi, and the rest much grazed over by the cattle of Haripur, the closing of these areas would cause much inconvenience to the people of those places. The remaining area of 1,094 acres is treated under the coppice with standards system, with a rotation of twenty years, which indicates an annual coupe of approximately 54 acres. It may, however, here be mentioned that an area of 104 acres in compartment 3, Barabagh, cannot be coppiced owing to the friable nature of the soil and the possibility of landslip.

The soil is a dry, somewhat shallow sand, strewn with blocks of micaceous sandstone and quartzite. If in future it is considered desirable to increase the rotation, it can be done by bringing some of the area at present excluded, under the coppice system. As the areas coppiced are to be closed to grazing for the first five years after exploitation, this will give a total of 271 acres closed at any given time, which is one-seventh of the forest area near Kalsi, and therefore cannot be considered excessive.

The annual coupes have been arranged not so as to follow each other on the ground in regular succession, but so as to avoid the inconvenience of closing the whole of 5 years' coupes in one spot, and also to avoid the possibility of coppicing a large area of Sal one year, and perhaps none the next, as Sal is not regularly distributed over the whole area. Speaking generally, the area is incapable of producing good, high-timber forest, on account of the very shallow, stony nature of the soil, while at the same time it is most desirable to get rid of the present stock of unsound and crooked trees which have no future before them. This it has been decided to do by leaving the few well grown trees at present standing on the area, and coppicing all such as are badly shaped and poorly grown. For standards, Sal, Sain, Haldu, Gausam and Bakli, with a few others in default of these, are preferred. There are certain free grants of timber or bamboos which have to be met, and this is done, as far as possible, from the excluded area before mentioned.

It was laid down in the Working Plan that in 1889-90, 53 acres in compartment 7 were to be cut over, in 1890-91 37 in compartment 6, and in 1891-92, 33 acres in compartment 5. Owing, however, to difficulties connected with the demand, none of these areas could profitably have been exploited: they were, therefore, left over till 1891-92, when a market for the produce was opened up at Chakrata, and the wood was sold for fuel to the cantonments at that place. In 1891-92, an area of 30 acres in compartment 7 was cut over and yielded 350 cu. feet of timber and 20,540 cu. feet of fuel. This compartment, the total area of which is 53 acres, occupies the N. E. slopes of a spur between the cartroad and the foot-path to Kalsi. Its average gradient is about 35°. Sal is abundant: and the standards, which are very few in number, are chiefly Sal, with here and there a Bakli or Haldu. The scarcity of standards is due to the difficulty of finding suitable trees.

The wood was cut departmentally at a cost of Rs. 2 per 100 cu. feet of fuel (cut in 2 foot lengths.) The stools were gone over afterwards, and trimmed by daily labour at a cost of Re. 0·15 per acre. The cost of carriage to Chakrata, where all the fuel is now sent, was Rs. 1 per 100 cubic feet from the jungle to the road, and Rs. 15 from there to Chakrata by cart. In the cantonments the wood was sold at Rs. 27 per hundred cubic feet. The stools are not very well cut, but the results are, on the whole, good.

The measurements of shoots by the students of the Forest School gave :—

January 1893 :—1,016 shoots of an average height of 6 ft. 5½ inches (of which 347 were Sal of an average height of 7 ft.)

January 1894 :—461 shoots of average height of 9 ft. 1 in., of which 179 were Sal of an average of 9 ft. 1 in.

It was discovered that *Combretum decandrum*, the common climber, has begun to do considerable damage, being especially thick in the lower part of the compartment.

In 1892-93 28 acres of compartment 6 were coppiced, and measurements made there in January 1894 resulted in the following :—

670 shoots of an average height of 6 ft. 4 in., of which 179 were Sal of an average of 6 ft. 7 in.

In the same year nine acres more of compartment 7 were cut over, the two areas yielding 431 cubic feet of timber (sold locally).

19,806	... ... firewood.
1,214	... ... charcoal.

With the exception of the cost of carriage of material from the coupe to the road, which varies with the distance to be traversed, and that firewood now fetches Rs. 25 per 100 cubic feet in Chakrata, the rates are the same as those quoted above for 1892.

This compartment has a Southern aspect and a drier soil than No. 7, with about the same slope as the latter.

On Saturday, January 13th, the Badshaibagh coppice was visited. This area lies on the southern slopes of one of the outer ranges of the Siwaliks, about one mile to the west of Badshaibagh, which is a small hamlet lying at the point where the road from Saharunpur to Chakrata enters those hills. Its northern boundary is the ridge of the outer hills, its southern the Badshaibagh Rau, which latter also defines it on the east, and its western boundary is another ridge. The soil is dry, poor and stony, and the subsoil is pebble bed or sandstone, with in a few places a band of red clay.

Two areas of 50 acres each were cut over, one in 1888-89 and the other in 1889-90 The financial results were, however, so poor that the system was abandoned. These areas were both cut over departmentally, and the wood was auctioned on the spot. The areas are still fire-protected, and the effects of the exclusion of grazing were very noticeable in comparison with the adjoining open jungle. The chief species noticed were Bakli (*Anogeissus latifolia*), Harsinghar (*Nyctanthes arbor-tristis*), *Zizyphus* of different species, Khair (*Acacia Catechu*), Tendu (*Diospyros melanoxylon*), Salai (*Boswellia thurifera*) &c., &c.

Measurements by the students have yielded the following data :—In 1892, in part of the area cut over in 1888-89 the measurement of 424 shoots gave an average height of 7 ft. 5 in.

In 1893 the same area gave for 553 shoots an average of 8 ft. 3 in., and in 1894 589 shoots gave 9 ft. 1 in. A visit to the areas was, however, useful as affording an example of the results of coppicing a piece of jungle of poor nature on a hotdry slope. The results are in places not bad, the condition of the crop having evidently been improved by the operation and the growth seen from a distance being already indistinguishable from the neighbouring jungle.

Passing along the foot of the Siwaliks eastwards from Badshaibagh, through the much overgrazed scrub jungle, which abounds along the edge of the Gangetic plain, the characteristic shrubs and trees of these areas were pointed out to the students. Three species of *Zizyphus*, namely, *Jujuba*, *Oenoplia* and *xylopyra*, also *Carissa Carandas*, were specially abundant. In the dry and stony soil of the Raus wherever a slight rise in the bed had left the soil fairly free of large stones, the curious Asclepiad *Orthanthera* was the first and almost the only plant to appear. In such places as had been raised above the level of the stream for a somewhat longer period, a considerable young growth of Khair (*A. Catechu*) was noticed to have sprung up. Associated with this at the sides of the Raus growing on the same poor sandy soil, were found Shisham (*Dalbergia Sissoo*), *Acacia eburnea*, *Mimosa rubicaulis*, and *Odina Wodier*, the Jhingan, the results of the tapping of which latter for resin were very noticeable in the formation, after constant repetition of the operation on the same spots for a number of years, of large lumps or excrescences on the tree.

Rising from the Rau beds to the summits of the hills the following trees were noticed :—*Buchanania latifolia*, Bakli (*Anogeissus latifolia*), Sain (*Terminalia tomentosa*), Khair, Aonla (*Phyllanthus Emblica*), Dhaura (*Lagerstrœmia parviflora*), Salai (*Boswellia thurifera*), *Zizyphus xylopyra*, &c., and uppermost of all the Chir Pine (*Pinus longifolia*). At Barkala very serviceable kind of Forester's quarters have been built. It consists of three rooms with a yard behind The total cost was only Rs. 560.

The next place of interest visited was the Sahensra coppice. This is an area situated at the southern boundary of the forest on the flat country at the foot of the hills. At its western end it abuts on the Sahensra Rao, and cuttings are travelling in an easterly direction. The coppice was only started in October 1893, and forty acres were laid down as the first year's coupe. These are now being cut over by the purchaser, who has paid Rs 80 for the whole produce. This, as all cutting and extraction are done by the purchaser, represents the net profit accruing to Government. A belt of one chain has been left along the boundary for the sake of protection from the encroachments of animals passing along the road.

Except certain Pipal and large hollow trees, from which shoots are neither expected nor wanted, it is made a rule that all trees must be cut flush with the ground, and to the credit of the contractor it must be said that the work could not possibly have been done better or more thoroughly. The shoots were absolutely flush with the ground, smoothly cut and domeshaped. The species were :—

Godgudàla (*Sterculia villosa*), Khair, Kharpat (*Garuga pinnata*), Tendu (*Diospyros melanoxylon*), Aonla (*Phyllanthus Emblica*), Kura (*Holarrhena antidysenterica*) Papri, (*Ulmus integrifolia*), *Odina Wodier*, Bael (*Aegle Marmelos*) *Zizyphus* several species, Salai (*Boswellia thurifera*) &c., &c.

Among these, the best shaped trees, of whatever species, are left as standards. The coppice is made in very inferior scrub jungle, but in the end it will have an extremely beneficial effect by substituting for a crop of crooked misshapen trees, bringing in almost no revenue, a coppice wood of tall shoots suitable for a number of purposes. The rotation will be twenty years, but the Working Plan is not yet completed. The demand at present points to such a rotation for the production of fuel which is being taken to Saharunpur.

On Thursday, January 18, camp was moved to Mohand, and part of the coppice was visited, but at Mohand owing to four days' extremely heavy rain, work was rendered impossible, and the thoroughness of the inspection consequently was in a measure curtailed.

SHORT ACCOUNT OF THE BUDHABAN COPPICE NEAR MOHAND.

The hamlet of Mohand lies at the southern extremity of the pass of that name, and the coppice is on either side of the Saharunpur-Dehra road, in the plain to the south of the village. The area is bounded on the north-east and north by the forest road from Badshaibagh to Hurdwar, on the south-east by the Mohand Rau, on the south-west by a belt of a forest, and on the north-west by the Khajnaor Rau. The coupes are divided by 10 ft. paths ; the ground is level, being part of the Ganges plain ; and the soil to the north is fairly deep, becoming, however, poorer as we procced southward. The subsoil consists largely of boulders, and is in great part old river bed. With regard to the growing stock, Sal is fairly abundant in some compartments, chiefly towards the north, the remainder consisting of inferior species. The Working Plan provides that from 75 to 80 acres are to be cut annually. The coupes are numbered from north to south in three parallel rows, so that No. 1 being on the north-east corner, No. 2 is directly to the south of it, and No. 20 occupies the south-west corner of the area. Until last year the coupes were cut up to No. 5 in regular succession, but since the *operation* of the Working Plan, they are being cut alternately, so that No. 7 will next be exploited. Up to No. 4 inclusive the compartments were cut departmentally. From No. 4 they have been cut by the purchaser. The wood is sold by auction in August, and the purchaser must remove it by March, a month's grace being, however, allowed in cases where the removal was unavoidably delayed.

In No. 4 the standards were very badly marked, the fault of the Range Officer, who had mutilated the trees in the marking, and in that compartment in December last 150 teak and 100 Mohwa with a few Chir pine have been planted in baskets in the blanks, the Chir especially doing very fairly well.

A small table of the yield and the revenue and expenditure is here inserted :—

Compt.	Date of cutting.	Area in acres.	Number of standards left.	Number of trees cut.	Expenditure.	Revenue. (*net*)
					Rs.	Rs.
1	Nov. 1888	70	926	27,873	264	600
2	" 1889	70	2,448	24,267	252	660
3	" 1890	70	none.	22,323	238	605
4	" 1891	80	1,400	no record	391	1,000
5	" 1892	75	665	...	...	630
7	" 1893	75	865	...	...	535

· Nos. 5 and 7 having been cut by purchasers the item of expenditure disappears. In Nos. 1 and 2 in 1893 it became necessary to cut the creepers, which was done by contract at a cost of Rs. 35.

Results of measurements made by students :—

No. of Compt. in which measurement taken.	Date of measurement.	No. of shoots measured.	Av. Ht. in feet.
1	Jan. 1892	274	10'-0"
2	"	281	9'-0"
3	"	581	6'-5"
2	Jan. 1893	940	12'-8"
3	"	849	7'-11¼"
3	Jan. 1894	782	9'-5¾"
4	"	807	8'-9½"

After two years' growth, the shoots reach such a height that measurement is difficult. It will be noticed from the table that comp. 3, lying as it does to the south, gives poorer results for the same age than either 1, 2 or 4 which lie to the north of it.

On leaving Mohand for Dholkhand a very useful and effective forest bridge made of rough cribwork was shown to the students, and sketches were made and dimensions taken.

IMPROVEMENT FELLINGS IN THE SAHARUNPUR DIVISION.

These have been made over varying areas containing Sal since 1884. The fellings are made primarily with a view to improving the condition of the Sal and Sain found in these areas by removing trees interfering with their growth, and also with a view to getting rid of badly grown and unpromising trees of all species. These are not, however, the sole objects. The operations differ from those being done in the Dún, in that all, or nearly all, the trees cut, are coppiced with a view to obtaining a re-growth in the areas from which the trees are removed. These coppice shoots will not interfere with the trees already on the area, and will in time help to complete the crop, and where this is young, as it very generally is, the coppice will in time give, with the trees left standing, a much more even aged crop than is now on the ground. In Lakarkot the coppice shoots from stools cut in 1885 are now hardly distinguishable from the rest of the crop. Sal poles of a foot in girth and over up to 1 ft. 5 in. are plentiful, and most of them over 30 ft. high. Kokat is also good, and many of both are evidently from pretty old stools. The beneficial effects of these operations were well seen in the Lakarkot block which was visited by the students on the march. The tendency of the fellings is to produce a less pure crop than under the Dun system, and this is a distinct advantage.

In 1892, about 250 acres were gone over in the Dholkhand blocks, climber being cut in the same year. Last year a nearly equal area was cut in the Andheri block, the climbers being cut the previous year. This year 400 acres in Gaj and 200 in Baniawala are being gone over, 3,945 trees of all sorts having been marked and cut departmentally and sold by auction for Rs. 860. The climbers do not, however, appear to have been cut, which is to be deprecated, as they are rather abundant.

REVENUE SYSTEM FOLLOWED IN THE SAHARANPUR DIVISION.

This was explained at length to the students on their visit to the Mohand revenue chauki on Friday, the 19th January. With regard *first* to the various sources of revenue of the chauki, we have first timber from improvement fellings, *secondly* coppice, and *thirdly* sales of standing trees previously marked up to a paid maximum per block to contractors and others. Villagers may also remove small quantities for personal use, on tickets taken at the chauki. Firewood is sold on tickets taken by purchasers at the revenue chauki, and also is the produce of coppice areas, thinnings and clearings such as lines, roads, &c. Grazing is also permitted on permit, which may be given for one year or for less periods down to a minimum of one month. Some of the grazing dues are realized by the Collector of the District at the various tahsils. Bamboos are worked by a system of blocks which will be explained elsewhere. These blocks are either leased to contractors or are cut departmentally. Grass and other minor forest produce is removed on contract, a lease for removal being given by blocks from the 1st October to the end of February. This lease may refer to all kinds of grass, fruits, thorns for fencing, fibres from climbers not from trees, &c. Gums and lac are leased separately, as are also honey and wax, horns and hides, and stone for building. Leases are not allowed to be taken on a minor forest produce contract. After the expiration of the leases, that is at the end of February, all the above mentioned produce is sold in small quantities on tickets issued from the chaukis, chiefly to supply the wants of villagers in the neighbourhood. At each revenue chauki there are two Forest Guards (here at Mohand, owing to its extensive business, there is also a Forester) whose duty it is to issue passes, usually up to the hour of 9 A. M., after which time they must patrol, returning in time to check the passes in the evening on the return of the holders. As has before been mentioned, persons wishing to remove, as a rule, small quantities of fuel, &c., are given tickets. These tickets are of six kinds, each kind of a different colour.

Brown	tickets,	for the	removal	of produce, to the	
		Do	do	value of	6 pies
White	tickets	Do	do	value	9 pies
Yellow	tickets	Do	do	value	1 anna
Red	tickets	Do	do	value	2 annas
Blue	tickets	Do	do	value	3 annas
Purple	tickets	Do	do	value	4 annas

These tickets are merely stamped on sheets of paper, sixty-four going to each sheet, and are issued from the Divisional Office at Dehra. The colours of these tickets are annually changed, which system has its disadvantages, as the ability of the buyers to recognize the value of a ticket from its colour is a useful means of proving that the Forest Guard is giving them the value of their money. On the back of the ticket is written twice over, its current number, the date, name and residence of the purchaser, the block for which it is available, and the kind of produce and its value. Half the ticket is torn off when the remover returns from the forest, and these half tickets, together with the revenue collected and the "Chalan" are sent to Dehra. Each pass or ticket issued is entered in a register, and a daily total of those issued is written up in a second register, in which latter are also placed the receipts for tickets sent to the Head Office. An abstract of the second book must be sent in to headquarters every month. Every week the Forest Guard at the Badshaibagh chauki despatches his revenue together with the half-tickets he has collected to the Mohand Office, entering at the same time in a receipt from the amount of his revenue remitted, and the Guards at all the other chaukis do the same. When all have arrived at Mohand the Forester opens all the envelopes, and prepares a treasury receipt form or "Chalan" for the whole lot, which is then sent with the half-tickets and revenue to Dehra. There the treasury receipt is made out at the Divisional Office in duplicate, one to remain at the Treasury and the other for the Divisional accounts. To persons wishing for a longer currency of permit than one day, which is usually the case for larger amounts of produce than those removed on tickets, passes are given. Passes are made out in triplicate and bear on their reverse sides information identical with that written on the tickets. One copy of the pass remains in the pass books and the second is taken from the remover on his return from the forest, the third remaining with the purchaser just as the half tickets did. The issues of these passes, which are all of the same kind, and the value of which is fixed by the entries made in it only, are also entered in the general register along with the issues of tickets. The counterfoils are treated in the same way as the half-tickets, and the revenue obtained is sent in along with that obtained from the tickets.

THE DHOLKHAND SAMPLE AREAS.

Sample plots are especially useful in India for trees which do not form distinct annual rings. Here the rate of growth must be ascertained by careful periodical measurement of individual trees. Where the factors of the locality differ considerably, the results taken from one sample plot cannot be applied over the whole area of a district, and a different area must be chosen in each different part, from which to draw conclusions. The larger the number of trees in the given area, the more accurate and reliable will be the data yielded. Without knowing approximately the rate of growth of a crop, the compilation of a Working Plan is impossible, as there is no means of forming an idea of the yield. At Dholkhand three areas are set apart in an averagely stocked part of the forest, with a view to ascertaining the rate of growth of Sal in this district. Each plot is surrounded by a trench.

Numbers 1 and 2 are each 200 feet square, the third area is half an acre. The first area was started in 1882, No. 2 in 1888 and No. 3 in 1890. All the trees to be measured are numbered with a small zinc label, and a ring is painted round the tree at about four feet from the ground, at which point all the measurements are taken. Area No. 1 is not thinned. No. 2 was heavily thinned when selected, only the best trees being left, the growth in girth of these being on that account much greater than in No. 1. Area No. 3 was thinned lightly in 1890, only certain trees being reserved for measurement. The growth in girth here may be expected to be more than that No. 1, but sufficient time has not yet elapsed to enable reliable conclusions to be drawn.

The measurements for the past few years have been conducted by the students, and this year the results were as follows :—

Sample plot No. 1 :—148 trees gave an average girth increment per tree per annum, calculating for eleven years, of ·46 in.

No. 2 :—96 trees for six years gave ·74 in. per tree per annum.

No. 3 :—44 trees for four years gave ·54 in. per tree per annum.

This last result being probably slightly smaller than the correct one, as the area was first measured in April 1890. The present age of the trees on the area is roughly 20 to 25 years, which estimate of the age is to some extent borne out by history, as the forests of the Saharanpur Division were taken over and fire-protected about 1870.

THE TIRA COPPICE.

On January 26th the camp was moved to Berihara, where the Tira coppice was visited. This area lies to the south of the Badshaibagh, Hardwar road and to the west of the Betban Rau. The coppice consists at present of eleven coupes, which up to the present have been laid out as they were taken in hand. The coupes are all marked off by a ten-foot path. No. 1 is towards the north nearest to the Forest Bungalow, and the area stretches as a long strip to the south of this. The areas are marked by numbered posts at each corner. They are fire-protected and closed to grazing, and three years ago the climbers were cut in coupes 1 and 2. This year the climbers in Nos. 1, 2, 3, and 4 have been cut at a cost of Rs. 10 per coupe of 75 acres. In 1888, the first five compartments were overrun by fire, which, however, did little damage in No. 5, as it was then but just exploited.

The following table shows the financial results of the undertaking:—

No. of coupe.	Area in Acres.	When cut.	No. of Standards left.	Expenditure Rs.	Revenue (net.) Rs.
1	75	1883-84	100	...	40
2	75	1884-85	200	...	145
3	75	1885-86	250	...	305
4	75	1886-87	300	...	400
5	75	1887-88	300	199	620
6	75	1888-89	978	100	420
7	75	1889-90	none	...	265
8	75	1890-91	...	...	300
9	75	1891-92	...	...	400
10	75	1892-93	...	...	380
11	75	1893-94	737	...	410

Nos. 1 to 4 inclusive were cut by contract, but this being found unsatisfactory, the operation in Nos. 5 and 6 was carried out departmentally, after which the coolies having become more skilful, the work was again allowed to be carried out by the contractor who purchased the coupe.

BAMBOOS IN THE SAHARANPUR DIVISION.

Formerly there were 16 blocks in this Division which yielded bamboos, and these were divided into three groups, one containing six blocks and the other two five each. One group was cut over each year, all the culms, which were more than one year old. being cut out and the new ones left. At present, however, they are grouped in the following manner :—

In the Western Range there are two blocks, Mohand and Khajnaor, to be worked departmentally, one each year. In the Central Range there are nine blocks, of which three are worked departmentally, one each year, namely Bam, Sukh and Chillawala. The remainder are leased for working, two in each year, namely Gaj and Andheri, Betban and Dholkhand, Golna and Maliwala. In the Eastern Range different conditions prevail. The Maiapur block has to be annnally opened to supply the demand of Hardwar pilgrims for holy water baskets, the makers living for the most part at Jawalapur. These men are allowed in on ticket, half the block being opened to them each year. The Ranipur block is worked departmentally every year, and the other three blocks, namely Harnaul, Chirak and Rauli are leased. A few clumps flowered in Ranipur block in 1891-93. The bamboos in Maiapur block, are often solid owing to the poor soil of that block. After cutting, the tops and side branches are taken off and used for fencing, the rest go to Hardwar where they are sold to the pilgrims as walking sticks, for only young bamboos can be used for the baskets previously mentioned. In the Rauli block the bamboos flowered and seeded in 1884-86. Regeneration was not successful owing to constant grazing, consequently only those seedlings which were protected by being under thorny bushes survived. Last year about sixty acres of this block were gone over and the thorny bushes over the young culms were cut back, the effect being markedly beneficial. In the Chirak block, there was a partial seeding which occurred in 1886-87, so that a fair number of clumps dating from that period are seen on the ground, intermixed with much older clumps which have not yet seeded.

With regard to the exploiting of those bamboo clumps, which are being done under departmental supervision, the following facts may be noted :—

The contractor undertakes to cut within one foot of the ground, leaving all bamboos of a year or less, and in cases where there are not enough young ones he leaves a few older ones, so that there should never be less than four in a clump. He is paid at the rate of two or one annas per score according to the kind of bamboo. All bamboos are brought to the depôt by the ranger's house. The kinds of bamboos are as follows:—

1st.—"Chr kalans," about three inches in girth, all solid, and consisting of the full length of the culm, used for roofing, flags, &c.

2nd.—"Saranchas," which are larger and hollow, with greater girth than the last, and 10 to 12 feet long, the rest being cut off. These are for spliting for trellis work, baskets, &c.

3rd.—"Bahis," which may be hollow or not, are rather thicker than Saranchas, and are about seven feet in length. They are used for cots, &c.

The cost of these first three is two annas per score.

4th.—"Chr khurds," less than "Chr kalans," otherwise similar, used for roofings, fishing rods, &c.

5th.—"Lathis" about the same as the last, but only five feet long and used for walking sticks.

6th.—"Rakmi bans," which are the tops of 2, 3 and 5, and are used for fencing, roofing, bottoms of carts, &c.

The first three kinds sell by auction for 6 annas per score; "Chr khurds" and "Lathis" for four annas, and "Rakmi bans" for three annas per score.

The contractor is also paid at rates varying from one anna to 6 pie per score, according to distance, for the carriage of the bamboos from the jungle to the depôt.

THE RANIPUR COPPICE AREA.

This is very similar in character and management to the rest of the coppice areas in the division. It is bounded on the east by a cut line, on the south by the forest boundary, on the west by the Ranipur Parao and the Rauli block. The area hitherto worked has been gone over from east to west, on the south side of the outer hills of the Siwailks.

The crop is somewhat inferior, with a little Sal in places, notably in the small concavities of the hill sides. The most important product is bamboos, which are spread all over the area. The rotation is, as usual, 20 years. The area is fire-protected and closed to grazing, the rest of the forests around being heavily grazed. About 1,180 acres are set aside for coppice, and as yet the coupes are laid out annually as they are cut. Up to 1892, the work was done departmentally, but last year it was placed in the hands of a contractor. The whole Working Circle will consist of seven coupes on the east side of the Rani Rau, which runs through the area, numbers 1 to 4 being on the south face of the outer hills, and 5 to 7 on the north side. Five more coupes will lie between the Rani and Rauli Raus, and eight more between the latter and Chirak. As has been before mentioned, special attention is paid to bamboos and offsets, and seedlings have been freely planted in coupes 3 and 4. Unfortunately, many of the offsets were taken from old clumps, which subsequently fruited, and they have consequently themselves seeded and will die down.

The following is a table of results :—

No. of coupe.	Date of cutting.	Area in acres.	No. of Standards left.	Revenue.	Expenditure.
1	Nov. 88	55	955	215	162
2	„ 89	55	850	210	103
3	„ 90	40	none	185	160
4	„ 91	57	none	241	241
5	„ 92	55	400	1,000	500
6	„ 93	55	1,327	300	Contractor.

It may here be remarked that in coupes 3, 4 and 5 a certain amount of cultivation was allowed in order to get the ground broken up for planting with teak and bamboo. The teak seed is obtained from the trees on the banks of the Ganges canal. The students spent several days in coppicing in compartment 7, and in cleaning bamboos in compartment 2.

Insect Pests in the Goalpara District.

The year has been rife in insect pests, and vegetation of all descriptions has suffered more or less, though no information has been received about damage done to cereals. From one end of the district to the other, trees exhibit total or partial defoliation, or show their leaves in strips or containing egg cells. In a minor degree the Orthopterous Mantis on *Dalbergia Sissoo*, the Hemipterous Cicada on the long, newly formed blades of *Saccharum* and *Andropogon* and a Coleopterous Chrysophora on *Shorea robusta*, *Careya arborea* and various *Acacias* have done a fair amount of damage. Considerably surpassing this, is the wholesale defoliation of Sal by the Lepidopterous *Dasychira Thwaitesii*, nor has it confined its ravages to this individual tree, but has invaded all the associated species, particularly *Bombax malabaricum*, *Careya arborea* and *Dillenia pentagyna*. Their depredations include lower hill forest, and mixed plain forest, deciduous or evergreen. Small in proportion as the latter class of forest is, confined to narrow margins along banks of streams, it has not escaped the common enemy. The forest growing on an almost laterite clay, that on the richer loam of the submontane regions, that of more recent formation resulting from scourings of disintegrated igneous rocks, or that on the humus-clad surface, with a poor sandy subsoil impregnated with mica, have all suffered in varying degrees. Pure Sal forest, however, suffered more than mixed, as did forest growing on the lighter poorer soil. The area estimated as affected cannot be less than 800 square miles, and no Sal forest whatever has escaped on the north of the Brahmaputra.

As far back as 1878, Mr. W. R. Fisher, now at Coopers Hill, reported the defoliation of 200 square miles of Sal forest by this same pest. His description of the caterpillar was not quite correct, as it is covered with long, erect, yellow hairs, with a black transverse stripe, the moth being a fluffy greyish white. It is possible, too, that he underestimated the area affected, as his observations closed early. From information collected and the writer's own observations during the last three years, it may be concluded that this insect, like the poor, is ever with us, but does not seem to have drawn much attention or comment in the interval. On a small scale, it has been known to have attacked tea bushes for years, but has not been looked upon as a very dangerous enemy. Its power for mischief has been miscalculated, however, as the sudden arrest of growth at its most active period of vitality has resulted in the death of a large number of new shoots, tender twigs and branches, and the foliage of many trees present the aspect of a severe burning. In addition to this, a year which opened with the promise of a most abundant seed supply ends with a crop, of which not more than 5% has seeded, the profuse inflorescence having suffered equally with the tender new leaves.

In May and June 1892, a few specimens of these caterpillars were observed, but heavy and continuous rain falling early in the year, possibly interfered with the further development and metamorphosis of the insect. In the following cold weather it was occasionally observed, but at about the close of March no less than 25 square miles were covered, the defoliation being complete. The operations were fragmentary, and of this area not more than 2 square miles were in one block. The insect confined itself to exposed situations, such as demarcated lines, fire lines, roads, &c., and trees growing on the poorest soils. That the affected area was not more extensive may be accounted for by the suggestion made in the Indian Museum notes that the parasites *Chalcis* (*Brachymeria*), *Euplœa*, and a species of *Perilampus* destroy the cocoons. The mere firing of the forest did not seem to retard the insect's energies much, as a portion of a Sal area badly burnt in February was not thereby excluded from the insect's favor. It is somewhat difficult to form an opinion regarding reasons for the wholesale appearance of the insect this year, but it is peculiar that like 1891-92, there was little cold weather rain followed by a long drought with very hot weather in the spring. In 1892-93, on the contrary, the rainfall was far above the average, and commenced on an extensive scale in March. It undoubtedly prevented the insect's expansion. The trees which suffered least, as far as seed-bearing is concerned, were the more mature, robust ones.

T. J. CAMPBELL.

Yield of Katha.

I had intended writing for our Journal a detailed account of the method of manufacture as practised here, in the Province of Gujrát, of *Acacia Catechu* wood extract (*Katha*, not cutch), but the necessary leisure has always failed me. As I start for Europe in a few days on two years' furlough, and my notes are likely to get mislaid in that time, I think I ought to send you at once a few figures obtained from my experiments.

6,335 lbs. of wood chips yielded 3,351 lbs. of moist katha, the weight of which when completely air-dried was 410 lbs., an outturn of 6·46 per cent. By moist katha I mean the soft precipitate, which is moulded with the fingers of one hand into small cones and put out thus to dry in the shade. To produce the above quantity of katha, 80 men and women were employed during 4 days, and 40 earthen fire-ranges, in the form of small tunnels, and having two parallel lines of three openings each in the roof for the boiling pots, were kept going from early morning until night fall. The cones were dry enough for the market about 3 weeks after the chips had been boiled.

The price of katha has been steadily rising, and I could sell in a single year all the extensive *Acacia catechu* areas of the Baroda State to the katha boiler. Last year the price of katha was Rs. 45 per 100 lbs. at the place of manufacture. In my experiment, which was possible through the kindness of the State lessee, the cost to that individual of 100 lbs. of katha was, leaving out annas and pies, Rs. 27, of which Rs. 8-8 went into the State treasury as royalty, and Rs. 18-8 to the labourers. From the balance of Rs. 18 per 100 lbs. must be deduced expenses for management, cost of journeys, pots, axes, &c., before we arrive at the profits of the lessee, which, however, do not average less than 20 per cent. on total outlay.

In this province of Gujrát, katha boiling is confined to a single aboriginal tribe, which calls itself Kathorias, from the name of their business. As a rule, they are fed and clothed (?) by the lessee, receiving a small money wage in addition calculated on the number of fire-ranges, which is also the basis for reckoning the amount of royalty.

I am glad that the Reporter on Economic Products to the Government of India has issued a separate corrected article on the manufacture of katha, for the original article in the Dictionary was a curious mixture of fact and garble, due to the authorities drawn upon having been quoted wholesale without the necessary sifting.

In sending to the Forest School last year, specimens illustrating Katha boiling in Gujrát, I suggested that it would be interesting to find out with the help of the Forest School Chemical Laboratory whether any proportion of catechin or tannic acid still remained in the boiled wood-chips. It would also be useful as well as interesting to ascertain whether the yield of 6·46 per cent. of Katha was the maximum obtainable from the wood used; also what difference in the proportion of catechin and tannic acid exists between Gujrát Katha and that manufactured in Oudh and Kumaon.

CAMP *viâ* BARODA,
29th May, 1894

E. E. FERNANDEZ.

II.—CORRESPONDENCE.

Legal position of Water areas inside Reserved Forests.

SIR,—Will you allow me a corner in the *Forester* for the purpose of putting the following questions:—

Can a lake, or tidal water-way, a river or any surface water be constituted a reserved or protected forest under our Indian Forest Acts or Regulations? Is there, in fact, inside the boundaries, as gazetted, of a reserved or protected forest, any sheet of water, in respect of which the Government can exercise control under, say, Sections 25 and 31 of the Indian Forest Act? Suppose, for instance, that Government is proprietor of a reserved forest A free of rights, except one public right of way leading to a lake B. And further, let it be granted that the surface area of the lake has been included in the total area of the reserve as notified by Government under Section 19 of the Indian Forest Act. Lastly, Government has issued rules, under Section 25 of that Act, absolutely forbidding the catching of fish in, and the removal of any forest produce from, the reserve. Under these circumstances, can a person, who, entering the forest along the public path, proceeds to catch fish in the lake, and, let us say, lines his basket with leaves of lilies gathered from the surface of the water, be legally punished for any offence under the Indian Forest Act?

"Q."

Iron making by means of gas-furnaces.

Through the kindness of a well-informed friend I am now able to state the facts as regards the direct method of iron-making by means of gas-furnaces. Reading the article on iron manufacture in Southern India, which you reprinted in March last, one cannot help being impressed with the idea that the direct method has become an established fact, but I regret to find that this is a mistake. My friend writes as follows:—"To my knowledge the 'direct method of iron and steel making in gas-furnaces, or by 'any other means has nowhere obtained any importance, either in 'France, in England and least of all in Germany. The old works of 'Siemens at Landore are still producing sheet iron by the Siemens-'Martin process out of scrap iron, with addition of ore. In England 'and North America an addition of ore takes place when pig-iron 'is worked up in reverboratary gas-furnaces. In Germany this 'addition is very rarely made. I do not think either that in Scandi-'navia the direct manufacture of steel out of magnetite is established 'on a commercial scale. Last summer, when acting as one of the 'judges for mining and metallurgy at the Chicago Exhibition, I 'had much intercourse with Swedish metallurgists without learning 'from them about a new method. It is true that much steel is 'worked up in Swoden in Martin furnaces and in small Bessemer 'furnaces, but always pig-iron is the principle basis, and ore and 'scrap iron form only additions. Altogether, whilst at the Exhibi-'tion I heard from no quarter of any kind of development of a 'direct method. I, therefore, disbelieve absolutely any news of 'such development."

From the above, it is clear that, apart from any processes which may exist in the experimental stage, the only direct use of iron ore has been as a supplement, and its application as such must naturally be limited. The ore serves to oxidize a portion of the alloys of the pig-iron. If we assume that 2 per cent. of silicon and 3 per cent. of carbon are to be oxidised by means of magnetite to produce silicon dioxide and carbon monoxide, we are permitted to add 23 per cent. of magnetite. The ore may thus, at the most, amount to one-fourth of the pig-iron. The promoters of the new iron industry would accordingly have to smelt three-fourths of their ore first into cast iron, or else they would have to introduce some equally costly reduction process, unless they can find out another way to utilize more of the ore in the crude state. If the promoters know of such an other way they would do well to make it public. If not, then it would be advisable for trials to be made, not in India but in Europe, at some place where all the resources of art, of machinery and of chemical industry are available. After the successful introduction of a method which would suit the special requirements of India, it would be further advisable as a final test to send a shipload of the very ore to the place of experiment, so that no doubt whatever could remain that a process had been found by which to make good and cheap steel and iron out of the Indian ore. Then, and not till then, would the success in India be assured. That the promoters of the scheme deserve every possible support is without doubt. They cannot do better just at this time when the low price of silver acts as a premium on local manufacture. The object is praiseworthy, but the difficulties are in proportion, and the promoter's motto is indeed appropriate "Gutta cavat lapidem."

H. WARTH.

Age of production of good seed.

SIR,

Can any of your readers inform me at what age or size (girth) deodar,—Pinus excelsa—spruce and silver fir produce seed *that will germinate and give rise to strong, healthy seedlings?* In the case of Chil (*P. longifolia*), trees under about 5 feet girth do not produce seed of the above description, and probably the same is true in the case of deodar, &c. I know that trees, 2 inches in diameter, of *P.. excelsa*, bear cones and that sometimes coppice shoots of deciduous species seed the first year, but such seed is, of course, useless for the purpose of natural reproduction.

"SEED"

Promotion in the Bombay Forest Department.

SIR,

I shall obliged if you will insert the following in your next number of the *Indian Forester* :—

A strong feeling of discontent exists amongst the covenanted officers of the Bombay Forest Department, owing to the rumour persistently current that an extension of service is about to be granted to the Honorable A. T. Shuttleworth, Conservator of Forests, 1st grade. That officer will attain the age of 55 years next October, his service in the department having extended over a period of 31 years, during 25 of which he has occupied the post of Conservator.

Any one who knows the Honorable Mr. A. T. Shuttleworth will be quite ready to admit that his untiring zeal and energy continually displayed throughout his long period of service in the interests of Government and the Department deserve some signal proof of recognition, but that that recognition should take the form of an extension of service, to the detriment of the prospects of a number of other officers already almost hopelessly blocked in respect of promotion, is most manifestly unfair.

The Bombay officers are singularly unfortunate as regards their prospects. Promotion has hitherto been exceptionally bad, and as there are only two appointments with a salary of over Rs. 1,000 a month many of the officers are so unfortunately situated that they can never hope to earn the ordinary retiring pension of Rs. 5,000 a year. What renders these disadvantages the more disheartening is the fact that the Forest Revenue of Bombay exceeds that of any other province in the empire, excepting Upper Burmah.

The following examples will be sufficient to show how unfortunately we are situated in the matter of promotion. In Bombay the two senior covenanted officers are Messrs. Macgregor and

Wroughton appointed to the Department in 1871. The former is Conservator, 3rd grade, the latter Deputy Conservator, 1st grade, both having 23 years' service. On the Government of India list of 1894 Mr. Gamble of the same year is Conservator, 1st grade, and the late Mr. Whittall was Conservator, 2nd grade. Junior to them in service, appointed in 1872, are Messrs. Hill and Popert, both Conservators, 1st grade, and Mr. Dansey, Conservator, 2nd grade, whilst in Bombay Mr. Hight of the same year is only a Deputy Conservator, 2nd grade. The difference is rendered marked by the fact that on the Government of India list two Conservatorships, 2nd grade, are held by men appointed in 1873 and 1874 respectively, and two Conservatorships, 3rd grade, by men appointed in 1876.

Another argument against the justice of an extension of service being granted to the Honorable Mr. A. T. Shuttleworth is the fact that under the new rules lately applied to covenanted officers of the Department, the latter are debarred from all prospect of a similar concession.

It is a question too whether such an act will not involve a breach of faith on the part of Government towards the officers now being trained at Cooper's Hill, who will enter the service under the idea that the rules under which they joined are now being applied.

Bombay Officer.

III.—OFFICIAL PAPERS & INTELLIGENCE

Experiments on the Calorific power of Woods.

We have received from the Inspector General of Forests, for publication, a copy of the correspondence relating to the experiments made in the Agricultural Chemist's Laboratory in Dehra on this subject. The following were the woods experimented on :—

Sal,	Shorea robusta,	From the Dehra Dun Forests
Sain,	Terminalia tomentosa,	
Jaman,	Eugenia Jambolana,	
Dhaura,	Lagerströmia parviflora,	
Safed Siris,	Albizzia procera,	
Kharshu	Quercus semecarpifolia,	From the hill forests of Jaunsar.
Moru,	,, dilatata,	
Ban,	,, incana,	
Chir,	Pinus longifolia,	
Kail,	Pinus excelsa,	
Rai,	Abies Smithiana,	
Morinda	,, Webbiana,	

A specimen of surface coal from the Dun, found in the School Museum, was also analysed. The calorific power of pine wood was the greatest of all the specimens tried. Then came the firs, then the oaks, then Sal and the plains trees, the last being Dhaura.

In regard to the Dun woods Dr. Leather wrote :—

"I have the honour to forward you the results of my determinations of the calorific power of the five samples of charcoal 'and of the sample of coal sent to me for that purpose.

'2. As will be seen from the figures appended ("evaporative 'power" of the the five samples of charcoal) the variation is not 'great, the lowest value being 12·34 for Dhaura, and the highest '13·32 for Sal. Sain charcoal seems to contain a considerable 'amount of "ash," *i.e.*, mineral matters, and this *might* prove a 'disadvantage, if the charcoal were employed in a furnace. The 'point could, however, only be determined from working on the 'manufacturing scale.

'3. The coal has a very much lower evaporative power than 'the charcoals:—

	CHARCOAL.					COAL.
	Sal.	Sain.	Jaman.	Dhaura.	Safed Siris.	Dehra Dun Coal.
Moisture ...	5·75	7·42	7·26	10·95	6·84	3·75
Carbon & other organic matters ..	91·10	83·66	89·66	86·15	89·56	
Ash ...	3·15	8·92	3·08	2·90	3·60	6·95
	100·00	100·00	100·00	100·00	100·00	
Calorific power (pure c=100) ...	88·80	84·90	85·40	82·30	86·90	76.90
Evaporative power... (—lbs. of water at 212°F evaporated by 1 lb. fuel.	13·32	12·73	12·81	12·34	13·04	10·54

And in respect to those of Jaunsar, he reported:—

"I have the honour to submit herewith the results of the ‘ determinations of calorific power and the analysis of the seven ‘ samples of charcoal handed to the Assistant Agricultural Chemist ‘ in December, 1893."

CHARCOAL.

	Khar-shu.	Moru.	Ban.	Chir.	Kail.	Rai.	Morinda.
Moisture ...	5·85	2·35	4·75	4·15	2·55	4·35	2·15
Carbon, &c. ...	92·05	92·10	91·30	94·65	97·10	90·80	96·80
Ash ...	2·10	5·55	3·95	1·20	0·35	4·85	1·05
	100·00	100·00	100·00	100 00	100·0	100·00	100·00
Calorific power pure carbon—100 ...	93·08	91·23	90·77	97·85	96·92	93·85	95·38
Evaporative power—lbs. of water at 212°F evaporated by 1 lb. fuel. ...	13·96	13·68	13·62	14·78	14·56	14·08	14·30

Reissue of the ‘Annales forestieres’ or ‘Revue des Eaux et Forêts.’

We have been asked to make it known to our readers that the Editor of the *Annales Forestières*, which comprises the ‘*Révue des Eaux et Forêts*’ and the ‘*Répertoire de Legislation et Jurisprudence*’ have been reissued, and that nearly complete sets of the publication for the years 1862 to 1893 are now available at the extremely moderate rate of 18 francs the set of 30 volumes. To those who regularly read the excellent forest periodical now edited by Mons. C. Broillard, late Nancy Professor and Conservator of Forests, it is astonishing that the price of 30 or 31 years' issue can be kept down to such a low figure as this ; and we recommend those of our readers who would like to possesss the set, not to lose the present opportunity. At the request of the Inspector-General of Forests we may say that we shall be glad to receive indents and the necessary money from intending purchasers, and to procure the books. There will be, of course, in addition to the 18 francs, a small sum for cost of transport, which can be divided afterwards among those who have indented and recovered from them when sending the books, by the V. P. Post. As we are sure it will be interesting, we add here, in the original French, the letter of the Editor to Her Majesty's Secretary of State on the subject :—

Monsieur le Secrétaire,

Permettez-moi de vous soumettre une proposition que j'ai déjà faite au Gouvernement belge, et qui a été trés favorablement accueillie par la Direction des Eaux et Forêts et par les Agents.

Depuis plus de 50 ans nous publions une Revue forestière, le seul organe français qui tienne au courant des progrès de la Sylviculture.

La première série, publiée sous le titre (Annales forestières,) et finissant avec l'année 1861, est depuis 30 ans épuisée. Une nouvelle série fut commencée en 1862; elle a pour titre, Revue des Eaux et Forêts, et elle est arrivée à sa 31ème année d'existence.

Nous avions offert au Ministère belge de lui céder, au prix de 18 fr. seulement, c'est a dire au prix d'abonnement d'une seule année, autant de collections qu'il nous était possible de composer en 40 volumes et d'avantage, compris parmi les années 1862 à 1892. Il a demandé 45 Collections que nous lui avons expédiées, frais de port, a la charge du Gouvernement belge.

Je prends la liberté de vous faire une proposition analogue, c'est à dire de vous livrer autant de Collections qu'il nous sera possible de composer en 30 volumes et au delà (Revue et Jurisprudence), commençant en 1862 et allant en 1892, et de vous les céder à 18 fr. la Collection au lieu de 300 fr., prix réel d'une Collection de 30 volumes.

Vous pourriez ainsi distribuer admettons 60 Collections de la Revue et du Répertoire à 1,080 fr. au lieu de 36,000 fr.

Il y a des volumes qui ont été épuisés par l'acquisition de la Belgique ; c'est la raison pourquoi j'offire des Collections allant seulement de 30 à 40 volumes.

Dans tous les cas, le prix de 18 fr. représente à peine le prix de la brochure et la valeur des volumes comme vieux papier.

Je suis persuadé, Monsieur le Secrétaire, qu'en distribuant à ce prix modeste une des meilleures Revues forestières qui existent, votre haute Administration contribuera à répandre le gout de la Sylviculture, en mettant entre les mains des Agents aux Indes, un excellent Recueil de Science forestière, de Legislation, et de Jurisprudence.

Je joindrai en plusgratuitement à chaque Collection, la table alphabétique des Matières que je prends la liberté de vous adresser sous bande par la poste.

La Direction Belge des Eaux et Forêts avait adressé une circulaire à tous ses Agents, afin de connaître ceux qui désireraient acquérir des Collections de la Revue.

Elle a rèuni toutes les demandes, elle a reçu et distribué les Collections, et c'est elle qui m'a fait verser le montant aprés paiement obtenu de ses agents.

Je pense que le Gouvernement des Indes en agissant de même, rendra un véritable service aux nombreux Agents qui ont reçu leur instruction à l'école forestière de Nancy, et qui trouveront dans notre Revue un enseignement excellent applicable à leurs travaux journalières. Votre haute Administration n'aura ainsi que les frais de port, et la peine de faire distribuer les Collections.

J'ose espérer, Monsieur le Secrétaire, que vous voudrez bien accueillir favorablement ma demande, et,

J'ai l'honneur d'être, avec l'expression du plus profond respect,

Votre tout devoué
T. ROTHSCHILD,
Editeur.

Paris, le 30 Juin 1893,
13, Rue des Saints Péres.

IV.—REVIEWS.

New Works on Forest Law and on Land Revenue Systems.

Mr. B. H. Baden-Powell has added to his many services to the Indian Forest Department and to Forestry in general, by writing an excellent treatise on *Forest Law* (1), unique in the English language, and which will be a standard of reference for the United States of America, and all British colonies, as well as for the British Isles, whenever these countries perceive the necessity for a proper organization of their forests, and wish to follow the example of India as well as of France, Germany and other European countries which have had recourse to forest legislation.

No one could be more thoroughly qualified for the above work than Mr. Baden-Powell. A member of the Bengal Civil Service, he was Conservater of Forests in the Punjab from 1869 to 1880, and from 1872 to 1874 he acted as Inspector-General of Forests, during Sir D. Brandis' absence on leave. He also assisted in drafting the Bill, which subsequently became the Forest Act of 1878, and he drafted the Forest Act of Burma (1881). In 1872 he was sent by the Government of India to Burma to investigate the extensive frauds in the teak timber trade. He left the Indian Forest Department in 1880 on being appointed Officiating Commissioner of Umballa, and he was afterwards raised to the Punjab Chief Court, which position he resigned in 1889 on his retirement on pension. His services to forestry have, however, never ceased, as he gave a course of lectures in Forest Law at the Dehra Dun Forest School in 1881 and every year since 1892, he has given a similar course of lectures to the

---

(1.) "*Forest Law.*" A course of lectures on Civil and Criminal Law and the law of the Forest (chiefly based on laws in force in British India), by B. H. Baden-Powell, C. I. E., London. Bradbury and Co., Bouverie St. 1893.

Coopers Hill forest students which indeed form the subject of the present book. Mr. Baden-Powell has thus had great experience in the control and working of Indian Forests, besides possessing a most complete and practical legal training, and one of the many benefits for which India has to thank Sir D. Brandis, is that owing to his tact and good judgement, the initiation of the forest legislation in India, and the instruction of the Indian forest staff in the subject, has been placed in such capable hands.

The present octavo volume of 500 pages is intended to replace Mr. Baden-Powell's '*Manual of Forest Jurisprudence*' of 1882, which is out of print, and the subject is now brought up to date, and considerably improved in arrangement and matter. The sketch of Indian Civil Procedure and of the Stamp and Registration Laws which were included in the former work, have now been omitted. The book is divided into 3 parts, each comprising a number of lectures.

Part I gives elementary notions of Civil Law, and in it lecture No. 1 is introductory to the subject. Lecturs 2, 3 and 4 are on the *Law of Persons and Things*, and lectures 5 and 6 on the *Rights of Persons over Things*, including an account of *Mortgage, Easements* and *Servitudes*, a detailed knowledge of the latter being so important in forestry.

Part II deals with the *Indian Criminal Law*, including that of *Procedure*, in lectures 7 to 13.

Part III deals with the *Forest Law*, lecture 14 explaining the reasons for a special forest law, and the *topics* it deals with; describing the various Acts and Regulations passed in India, with the exception only of the recent 'Assam Regulation,' which was probably received too late; and giving an account of the Rules which are made under the Acts. Lecture 15 is on State property, and gives an account of the state of the law regarding the right of the State to all waste lands not lawfully occupied; and of the classes of public and acquired property. Lecture 16 explains what lands are subject to the forest law. The important statement is here made that the term *protected forests* was only suggested in the Draft Bill prepared for the Forest Act of 1878 as a temporary expedient, for the framers of the Act considered it impossible to take all State waste land in hand at once and deal with it as Reserved Forests, which entailed a complete enquiry into, and final settlement of, all rights over any forest in question. Their views were unfortunately not accepted, and a class of *protected forests*, not properly or permanently secured, was founded by the Indian Legislature. At the end of this lecture is a valuable Appendix, with a *resumé* of the European law in different countries regarding the control by the State of communal forests and forests belonging to corporate bodies and institutions. Lecture 17 gives the legal steps to be taken in the constitution of forest estates, and lectures 18 to 22 explain forest easements, and how they may be regulated, or extinguished. An Appendix to Lecture 22 gives an "Abstract of the German Law regarding Regulation and Extinction by Compensation of Forest rights," which is most interesting and deserves careful study, especially in view of cases which may very well occur in parts of India in which the growth of rights, or of privileges amounting to rights, makes their extinction by purchase a necessity if the area concerned is to be maintained at all as a forest estate. Lectures 23 to 25 are of the legal protection of forests and their produce in transit, and the two final lectures 26 and 27 on the legal organization of the Forest Service. We have here a complete and well arranged scheme dealing most thoroughly with forest law, and greatly facilitating its study and practice in India.

The 2nd book before us is a neat little volume in 260 pages with a map of India, showing the areas under the different kinds of land revenue settlements. Mr. Baden-Powell's '*Land systems of British India*' (2) in three large volumes is really intended to act as a Gazetteer for all the provinces in British India, the land systems in each of which are dealt with separately. The present volume gives sufficient practical information to serve as a text book for Forest Officers and others outside the land-revenue department. It consists of two parts: part I, in 5 chapters, gives a general explanation of the Land Revenue of India, including notes on the features of the country, climate and other matters affecting the land revenue administration; the organization of the provinces and districts with reference to it, and finally what lands are liable to pay land revenue, and the rules for the disposal of waste lands.

Part II gives an account of the different tenures of land in British India and the land-revenue systems, including the different settlements with landlords, villagers, or farmers (raiyats) which prevail in different parts of India. The old land revenue was taken in kind on the threshing floor by the Mogul's agents to the extent of one-third, or half, the grain. This payment in kind was afterwards commuted into a money payment, the principle being to take as much as the farmer could stand without being actually rendered a pauper, and unable to cultivate for another year. The British attempts at the settlement of the land revenue are all well described, the permanent settlement of Bengal and Northern Madras, the raiyátwari settlements of Madras and Bombay and the village settlements in Northern India, which are subject to revision every twenty years. The difficulties of the revision which might last four or five years, and upset all the country side, are fully explained, and also the present way of keeping a careful record by means of village officials of all the data of production, and all changes in land ownership which occur, so that land revenue records are always up to date, and a

---

2. "*Land Revenue in British India.*" By the same, Oxford, Clarendon Press 1894.

revision can be carried out with the minimum of trouble. Curiously enough, Mr. Baden-Powell states (page 50) that land permanently settled is not more valuable, and does not sell for more than land subject to revision of settlement, a strange comment on the folly of the permanent settlement, which forfeited so much national wealth for the profit of the Bengal and Northern Madras land-owners, who after all were originally mere revenue agents.

As regards the proposed cadastral survey of Bihar, so desirable for obtaining useful agricultural statistics and for guiding the action of Government in case of famine, and for protecting the rights of the raiyat, Mr. Baden-Powell thoroughly justifies this measure, and states that the objections to it really rest on the old world relations of Zamindar and Raiyat, under which everything was in the loose and unordered condition dear to oriental managers. The zamindar was then able to do what he liked, and to be absolute master, while the peasant was his slave.

After carefully reading this treatise on the Land Revenue of India, it may be confidently recommended as a most concise and clear account of a very intricate subject.

Report of the Agricultural Chemist to the Government of India for 1892-94.

There is not much in Dr. Leather's Report to interest the readers of our Journal, but we see that he has been very hard at work, and has visited most of the Provinces in India and seen what he can of the systems of agricultural work carried on in each.

We should have liked to hear more of the details of the experiments carried on by Babu Lachman Pershad in Cawnpore and Captain Chapman in Oudh on the reclamation of ravine land, and hope that some day Dr. Leather will tell us what has been done. Under the head of 'Fuel Reserves' mention is made as follows of a private work of which we should like to hear more.

"*Fuel Reserve.*—On a proportion of the land near Cawnpore to 'which reference has been made in paragraph 15, Babu Lachman 'Pershad has established a 'fuel reserve' for the benefit of his 'tenants. Timber was to be cut last year for the first time, and 'at my suggestion Babu Luchman Pershad kindly promised to 'have a record kept of the weight of wood which was obtained 'from the area cut. In a few years valuable information may thus 'be obtained.'

The remarks about *usar* are somewhat disappointing, the only thing that Dr. Leather seems to have ascertained is that under protection from grazing the amount of salts in the soil decreases owing to the opening of the soil by the roots of plants to the passage of water and into it of the soil.

We are glad to see that the work of Mr. S. H. Collins, the Assistant Agricultural Chemist, is specially commended. We are ourselves indebted to him for his valuable researches in regard to Kutch, charcoal and turpentine for the Forest Department.

VI.—EXTRACTS, NOTES AND QUERIES.

Afforestation in the British Isles

The question of extending the woods of the United Kingdom has recently been brought forward in the Press, and questions have been asked in Parliament as to the willingness of Government to assist in furthering a scheme for stocking certain of our waste lands with trees. Now afforestation may be required owing to those indirect advantages it affords to the climate and soil of a country, which have been described in detail by Dr. Schlich, and again quite recently in Nature, by Dr. Nisbet, or merely to increase the national wealth in forest produce. In our case, forests are certainly not required merely to reduce the air and soil temperatures, or to increase the atmospheric humidity; they may afford useful shelter against the strong westerly gales, or cutting east winds, and in our more mountainous districts they may assist in preventing denudation of the soil, which on a large scale has proved so destructive to agriculture in the Rhone Valley and other regions, but is not very much to be feared in our islands.

The chief use of forests with us is, therefore, for our timber supply, and to render us more independent than at present of imports of this valuable and bulky material, the inland transport of which is so costly Our mild moist climate is admirably adapted for producing oak, ash, beech, and other broad-leaved timber, as well as larch, silver fir, Scotch pine and spruce; and were the land stocked with trees whenever experience shows that it cannot be profitably used for agriculture, our wealth would be considerably increased, and so would be the demands for agricultural labour.

Exclusive of an import of £3,000,000 worth of teak, mahogany and other tropical woods, which we cannot grow ourselves, we also import annually £12,000,000 worth of oak, ash, and coniferous timber, all of which we might grow at home. Dr Schlich has estimated that if 6,000,000 acres of our waste lands were planted they would eventually yield sufficient timber to render these latter imports unnecessary. It is even probable that a smaller area would suffice, were the productiveness of our existing woodlands increased by better management

This extension and improvement of our woodlands is the more urgent, as the forests of Canada, Scandinavia and Russia, from whence most of our timber imports come, are not sufficiently well managed to secure the production of a steady supply of timber for export. The markets for their timber are also extending in France, Italy, the Netherlands, the United States, South Africa and other insufficiently wooded countries. The following table, comparing the ratio of the woodland area in 1892 of our own and other European countries, with their total area, places us at the bottom of the list:—

Name of country.	Area of forests per 1,000 acres.	REMARKS.
	Acres	
Austria-Hungary ...	343	Area of forests less by 102,000 acres since 1872
Russia ...	342	
Germany ...	257	
Sweden and Norway ...	250	
France ...	159	Countries importing more timber than they export
Italy ...	145	
Belgium ...	143	
Holland ...	72	
Denmark ...	60	
British Isles ...	39	

If our present area of woodlands, 3,000,000 acres, were increased by 6,000,000 acres, as proposed by Dr. Schlich, we should still have only 117 acres of woodland per 1,000 acres total area, and should stand between Belgium and Holland on the list.

These 6,000,000 acres would chiefly be taken from our unenclosed mountain and heather land, which, in the agricultural returns for 1892, is given as 12,117,000 acres for Great Britain, figures for Ireland apparently not being available. But as in 1880 there were 4½ million acres of waste land in Ireland, it is probably within the mark to estimate the total area of unenclosed mountain and heather land for the United Kingdom at 15 million acres.

Much of this land is at present used for pasturing sheep, and leased in the Highlands of Scotland at from one to four shillings an acre, according to quality. Large areas of it are also let as deer forests; the rent being fixed at about £25 for each stag which may be shot; and as 2,500 acres will support about 25 deer, five only of which are mature stags, the rent of average deer forests, exclusive of the buildings on them, cannot be more than one shilling an acre. It is the poorer lands at high altitudes, where sheep pasture does not pay, which are generally let as deer forests.

The cost of planting or sowing varies considerably according to circumstances, and is given in Brown's "Forester" (1882) as varying between £3 and £10 an acre, according to the nature of the fencing and draining required, which are the chief items. In calculating the returns from a plantation, the initial cost of planting must be reckoned at 2½ per cent. compound interest up to the date of felling, and this sum deducted from the proceeds of the felling. Any intermediate proceeds from thinnings will of course be added with interest allowed up to the date of the final felling.

Before a land-owner would venture to plant his land on a large scale, he would have to answer the following questions :—

Is the land suitable for the successful growth of any particular forest species, and if so, what are these species, and how should they be grown? Will the sale of the timber be more profitable than the present rent of the land? As a rule, most of these rough pasture lands, except in their moister depressions, are only fit for conifers, and in many cases only for Scotch pine. A large part of the area also is at present stocked with game, and although forest growth may be compatible with pheasants, black game, capercailzie, or a moderate number of deer, it certainly cannot be expected to thrive where rabbits abound; so that the value of the land as a game-preserve will also intervene.

Experiments might certainly be made to plant up the extensive tracts in the Midlands and elsewhere, which are now encumbered with shale and slag from abandoned ironworks, and which may be bought for an old song. Ash and maple grow well on heaps of slag in the Ardennes, and these species, and probably some others, might certainly be planted on similar areas in our black country. It is true that the cultivation of trees will not prosper within a certain distance from factory chimneys belching out sulphurous and other noxious fumes, but means may be adopted to fix the sulphur within the factory, and to prevent the air from being contaminated; whilst much of the shale and slag is already sufficiently distant from the obnoxious chimneys.

As regards the increased demands which an extended area of woodlands would afford to labour, Dr. Schlich has calculated that if 6,000,000 acres of our waste lands were planted up at the rate of 300,000 acres a year, this would employ annually some 15,000 labourers, and that eventually, once the forests had been grown, about 100,000 labourers would find in them steady employment, besides the large number of hands required by the special forest industries which this large forest area would certainly call into existence.

Such an industry already exists in the chairmaking business of Buckinghamshire. The forests on the Chiltern Hills supply thousands of people with beech-wood, 500,000 cubic feet of which are worked up annually into chairs in the town of High Wycombe and the surrounding villages. Some of these beech forests are getting thin and unproductive, owing to excessive felling and other bad management; but wherever a moderate amount of care is taken not to overcut the woods, as much as 20s. an acre per annum is obtained, without any expenses for planting, as the beech reproduces itself naturally. The poor dry soil above the chalk, on which the beech thrives, would, if the forest were rooted up and the soil limed at considerable expense, only yield a rental of 12s. an acre as farm-land. Evidently here we have a district where forestry is more productive than agriculture, and where planting might be extended; and the same may be said of the large area of heather land above the Bagshot Sands in Surrey, Berkshire, Hampshire, which might all be stocked with conifers were sensible measures adopted to stop the progress of the annual heath fires.

When it is remembered that we import 70,000 tons of pit-props every year, chiefly from the cluster pine forests near Bordeaux, and that in the Belgian Ardennes, at a distance of 80 miles from the coal mines, 40 year old Scotch pine, used for pit-wood, can be sold standing for £55 per acre, exclusive of the value of thinnings, which would pay for the cost of producing and tending the forests, and this means an annual profit of 16s. an acre, including an allowance for compound interest at 3 per cent., there can be no reason why we should not grow our own pit-props on waste land unsuitable for agriculture.

Many farms on heavy land are at present either going out of cultivation or paying very badly, and as an example of the successful forest treatment of similar land on the London clay, the Princes Coverts, near Esher, in Surrey, may be cited.

Leopold of Saxe Coburg, the consort of our Princess Charlotte, and afterwards king of the Belgians, about seventy years ago united several small woodland areas, by planting up the land of two farms, in which they were situated, with hazel and ash coppice and oak standards. The present extent of the coverts is 868 acres, and their yield, after deducting all costs of management, amounts to at least 16s. an acre per annum, and probably more; but Messrs. Clutton, the agents of the Crown lands,* in which these woods are at present included, might supply the correct figures. The coppice is felled every ten years, and yields supports for fruit and ornamental trees, bean and pea-sticks, clothes, props, kindling fuel, &c., which are largely in demand for gardens, orchards, and laundries around London; while the oaks, which in seventy years attain a girth of about five feet, are readily sold standing at 1s. 6d. and 2s. a cubic foot, according to quality.

Whilst, however, the work of planting up our waste lands must necessarily be chiefly left to private agency, the State should bring the Crown forests into a high state of productiveness, and render them examples of good forest management. Forestry is eminently a practical business, and when a land-owner wishes to plant, he should be able to see the ideal way of dealing with different localities on economic principles in our Crown forests. This at present is far from being the case. Very large sums of public money were spent in planting up the Crown forests in 1818-25, when there was a fear of our running short of timber for the Navy. It is true that our Navy now depends on teak and iron, rather than on oak and pine; but oak and pine are still valuable commodities, and the present condition of the Crown plantations, made about seventy-five years ago, is certainly not satisfactory, owing to the want of underwood, and the excessive nature of the thinnings to which they have been subjected. Over an extensive area in the New Forest the Scotch pine mosses have been allowed to outgrow the oaks they were intended to shelter temporarily. The fact is, a forester is wanted at the head of our Crown forests, who will see among other things, that they are properly underplanted, and that all blanks are restocked ; but in order to do this successfully, the rabbits, which now swarm in some of the woods, must be kept down. This was not the case twenty years ago ; but their increase of late has been prodigious, and they not only eat every natural seedling which appears, but also threaten the existence of the older trees by barking them in the winter.

It should be noted that the Crown forests are managed by the State, and their proceeds go into the Treasury, but that the sporting rights in some of them are vested in the Crown. Surely the Royal sportsmen might be contented with a moderate number of rabbits, and with pheasants which do no injury to the woods, and not require the enormous multiplication of rabbits, which no continental prince would suffer in his forests

It may be objected that by treating our Crown forests for economic forestry, as is the case with the Crown woodlands in other European countries, we should introduce uniformity, and spoil much of their picturesqueness. There are, however, 5,000 acres in Epping Forest, 4,000 in Windsor Park, and extensive tracts in the New Forest, which might be reserved for the lovers of the picturesque, and even then 100,000 acres might be found in the Crown forests which could be made into models of good forest management, which are at present not to be found anywhere in Britain.

W. R. FISHER.

(*In 'Nature' for April 26th. 1894.*)

The Planting of waste and unproductive Moorlands in the Highlands.

(From the *Scotsman.*)

To how many of those who know our Scottish Highlands does it occur that those miles and miles of heather, characteristic of our scenery, may not be a natural growth, but, on the contrary, the product of a rude cultivation? Immense tracts in North-Western Europe, once known to have been densely wooded, are now covered with a vegetation in which heather predominates, and though most of us know that in the history of every country man at one time or another destroyed a greater part of its forests, few consider that it is only by continual effort that a forest vegetation is prevented from again taking possession of the soil. Let but nature have her own way with a bit of moorland—she may take ten or twenty years or much longer to do it, depending on the distance from a forest, character of the soil, and other circumstances—sooner or later there will be found a few firs struggling to gain the ascendency; a few birch, willow, and aspen seedlings scattered amongst the heather. In short, the bit of moorland is becoming a wood. But by periodical burning, the grazing of cattle and sheep, and overstocking with game, all promise of a future forest is choked at its birth. Considering the needs of the present day, are we affecting the balance of nature to our advantage? Competent authorities declared that were nature given a free hand those immense tracts of heather in the north-west of Germany would in time be again clothed with forest. Too much practical value, however, does not attach to the fact, and so there, and in many other parts of the Continent, the forester comes to the assistance of nature, and yearly claims large areas for his operations. What answer should we in Scotland give to the question—Would it be wise to plant on a large scale our waste and unproductive moorlands? The science of forestry has in this country within the last few years made some progress towards attracting the public interest due to it; and, since the subject has lately been mentioned in Parliament, not a few may have sought an answer to such a question. It may be useful, then, to present some arguments of general interest for and against the planting of our heather-clad moors and hillsides.

The private individual will probably first ask. Will it pay? Taking into account cost of planting, rent of land, and so forth, shall I receive a sufficient return in hard cash? This is a most difficult question, and one only to be answered in specific cases. A man who is willing to spend money on the afforestment of waste lands must remember that money thus spent accumulates with compound interest to a large sum in 80 to 100 years, before which time, except in the case of copsewood, he cannot reap his harvest. The result, indeed, often proves that the ultimate profit would have been greater had he received a small annual rent for the land, say for sheep grazing. The very fact that he is making a sacrifice for the benefit of others, that during his lifetime he can hope for no pecuniary return, prevents many a landed proprietor from considering the matter at all. Woods are, however, planted, and where they already exist, preserved, with other objects in view than a mere direct return in money. The beneficial effects of forests on climate —conservation of moisture chiefly— are well-known. Then, in the case of steep mountain sides, the heavy rainfall which on a bare slope would rush down, carrying the soil with it, and swelling the rivers into sudden flood, will, where the slope is covered with forest, disappear in its carpet of moss, leaves, and humus, which, like a huge sponge absorbing many times its own weight in water, forms a reservoir feeding surely and regularly spring and rivulet. In the high Alps a forest hinders the formation of the dreaded avalanche, and on the coasts of France and Germany the serviceable fir binds the drifting sand. Forests also afford a capital cover to all kinds of game, and what is of great importance in our time, they gave directly and indirectly employment to a considerable population. For these and many other reasons forests are important in the economy of nature and of society. But in favoured Scotland, although her forests are few, the climate, as regards moisture, leave nothing to be desired; the rivers do not in spring come down in disastrous floods, to be dried up for the rest of the year; no avalanches carry death and ruin down the sides of Ben Nevis or Ben Cruachan; nor are there on our coasts thriving villages and prosperous towns in danger of being engulfed by driftsand; it almost seems as if the grounds urged for afforestation in other countries could have no weight with us. Still it would be wrong to suppose that no arguments remained in favour of planting the waste land of this country. There can be no doubt that forests play an important part in improving the soil. They would also add much to the beauty of our scenery, besides affording shelter to various kinds of game. Red deer, it is true, prefer the solitude of corrie and glen to patches of woodland, where they do not feel secure; but the forests, broken only by a few open glades and cultivated clearings, was once their home. Grouse would probably always keep to the open moors, but with roe deer, capercailzie, black game, hares, and rabbits, it is otherwise. Roe deer and capercailzie are no great friends of the forester, but the damage done by them is only serious in the case of small detached plantations. In many well-wooded parts of the Continent both are numerous, yet few complaints are made. Rabbits alone are an unimitigated nuisance, and their numbers must be kept within reasonable limits. At a time when much is heard of the depopulation of the highlands, it is important to remember that the afforestment on a large scale of our waste and unproductive moorlands would now permanently give employment to a large proportion of our crofter population. In winter, when others find work scarce, the woodcutter is fully employed. In spring the work of sowing and planting may largely be entrusted to women and boys. In summer the men can employ their spare time in mending the roads in the forest, putting up fences, and other odd jobs; while in autumn little or no work need be done in the woods, all hands being busy at the harvest. Many of us who have been on the Continent have seen in the Harz mountain, Bavarian Alps, and elsewhere, happy and prosperous villages. the existence of whose inhabitants, the soil fit for the plough being scarce, depends on the employment they find in the surrounding forests. Is there a village in all Scotland where the inhabitants depend on the surrounding grouse moors and deer forests for their existence?

The crofters are in urgent need of some employment to enable them to better their condition: still it would in most cases be unreasonable to expect the private individual who receives a high annual rent for the grouse shooting on his moors to drive away this game planting, thus giving up his certain income for the sake of a mere speculation. If anything of importance is to be done, it must be by means of a Govenrment scheme. Present sacrifices may be necessary, but such a scheme will prove remunerative, provided the operations be conducted on a large scale, and the education and experience of the foresters be such as to ensure that the initial expenses shall be as small as possible, and the result show a crop of valuable timber. Not another country in Europe offers so favourable a field for the operations of afforestation. Seeing it is by no means certain that the countries from which we now draw our timber supplies may not become, at least in part, exhausted, it is high time we gave the matter our earnest consideration. All are agreed that timber can be grown in Scotland as good as any imported; let us hope the day is coming when home requirements will largely be satisfied by home-grown timber.—(*Timber Trades Journal.*)

The Utilisation of waste wood and Sawdust.

The numerous saw-mills and wood-working machines used in the colonies, and in large timber-growing countries generally, find, not infrequently, that there is a difficulty in the disposal of their waste wood and sawdust. In a few large wood-working establishments at home, enterprising proprietors have set up chemical apparatus for utilising these products, and recently Mr. W. Hadfield-Bowers, Brookfield Chemical Works, West Gorton, near Manchester, has introduced a machine for this special purpose. It is known as the "Bowers" Patent Retort and Drying Oven, and has been in use for nearly a year, doing all that is claimed for it in recovering useful products from waste wood and sawdust. The case with which the apparatus can be set up and manipulated should be an important factor in recommending it to the use of saw-mill owners and wood-working factories abroad. It consists of an iron chamber pierced by a central flue which divides the chamber into two divisions, an upper and a lower. The fire under the bottom plate heats the lower chamber; the waste heat from the lower chamber passes through the central flue and heats the top chamber. The wood or sawdust to be dried or carbonised is fed into a hopper from which it passes automatically to the bottom part of the upper chamber, where it is moved forward by a pair of endless chains carrying bars to the end of the chamber, where the materials fall upon the bed of a lower chamber, and are slowly conveyed towards the fire end. The chambers are so arranged that there cannot be any escape of vapour; and thus all the pyroligneous products in the drying process are condensed and collected. The apparatus can then be used for thoroughly carbonising the spent material, as well as for the ordinary drying of such substances as spent dye-woods, tanning materials, fossil meal, brewers' grains, &c.—(*Timber Trades Journal.*)

To make the Black Country Green.

A very interesting social experiment has just been conducted by Mr. Fisher, the Assistant Professor of Forestry at Cooper's Hill. Mr. Fisher has inspected a considerable area of what is to outward view the most hideous and forsaken district in England—the Black Country. The soil is covered with the wreckage of abandoned coalpits. The rush of men too hasty to be rich has passed over its acres, and left them black, bare, apparently sterile. But Mr. Fisher is convinced that one or two hardy specimens of trees would flourish there, and that a careful experiment in planting would turn the country green again. The trial would not be costly one. Will not the Government (asks the *Chronicle*), or, failing them, some disciple of Mr. Ruskin, help to recolour at least a few hundred acres of the Black Country?—(*Extract*).

Forestry at the Surveyors' Institution.

An excellent catalogue of the forestry collection at the Surveyors' Institution has been issued, indicating the energy and care with which this useful section of the Institution's work is conducted. Although weak in some classes the collection already gives evidence of its future utility, when it should prove of the greatest value to students preparing for examination for the forestry diploma. The classification is comprehensive, the exhibition being arranged into the following sections, *viz.*, practical forestry, forest produce, scientific forestry, illustrations of forestry, forest literature, and forest economy. These, with their subdivisions, are copiously illustrated, and of the greatest interest to those concerned with the management of woodlands.

The section devoted to economic forestry is of great value, as it deals with the results obtained from planting. Mr. James Price C. E., consulting engineer for railways at Dublin, sends a sample of larch planted in 1861-62 and cut in the spring of 1893. The trees from which this was cut were grown on a loose, rocky soil in Louth Co. The value of the land was about 4*d.* per statute acre. Owing to the droppings and the shelter larch, a fine grass has been grown, and the land is now five times more valuable for pasture than it would have been had the trees never been planted. Some of the trees now measure 3 feet in girth outside the bark. The catalogue states that if two-thirds of these trees were now cut down they would be worth from 1s. 6d. to 2s. each, while the remaining third will be worth 5s. as railway sleepers in twelve years. Another sample in the collection affords almost as interesting a proof of the value of afforestation. This is a specimen of alder planted in 1861-62, and cut last spring. Although grown in poor ground the trees are tall and straight, and some of them measure 14½ inches in diameter inside the bark.

Home timber merchants and others when in London will be able to spend a profitable hour at the Surveyors' Institution, and some of them might added to the utility and interest of the collection of woods now being got together by sending specimens.—(*Timber Trades Journal.*)

The growth of Trees.

The editor of the U. S. *Monthly Weather Review* comments on a series of measurements of the growth of trees, made by Mr. J. Keuchler, of Gillespie County, Texas, about two hundred miles north-west from the Gulf Coast at Indianola. Mr. Keuchler seems to have adopted the idea that a tree bears the history of its climatic surroundings written in itself, and that its annual rings of growth vary in size mainly with the supply of water to the roots, so that broad rings indicate wet years, and thin rings that can scarcely be distinguished with the naked eye denote dry years. After carefully selecting trees for his measurements, he felled three oaks, two of which were over 130 years old. He cut a perpendicular section from each trunk near the thick end, planed its surface very smooth, and then varnished it over which made the annual rings distinctly visible. From each section a table was prepared of the relative order and position of the annual rings; upon comparing these three tables they were found to correspond exactly, thus indicating that moisture is the principal cause of the difference in the breadth of the rings. Taking the width of the respective rings as a criterion of moisture the record of 134 years shows six years extremely dry, eight very dry; 19 dry; 17 average; 18 wet; 60 very wet; six extremely wet. The editor of the *Review* points out that the large number of very wet years is not at all in accord with the rainfall records during the years 1840 to 1890, and, in fact, no region on the globe is known where the distribution of the rainfall is similar to that given by these records. It is evident, therefore, that the breadth of the annual rings of growth adopted by Mr. Keuchler as corresponding to dry and average and wet seasons needs considerable modification. The width of the annual rings depend, at least in part, upon evaporation, the sunshine, the temperature, and the distribution of rain in frequent showers or in frequent heavy floods. It is the combination of several favourable meteorological circumstances that must have produced the large number of broad rings which Mr. Keuchler has attributed to 60 very wet years and six other extremely wet years. In fact it is best not to attempt to establish any fine details as to the climate from such a record of tree growth, but to be content with the general statement that there were 14 years during which the climate was unfavourable for the increase of woody fibre, 54 years during which there was an average favourability, and 66 years that produced large growth owing to very favourable conditions. All that can safely be concluded is that during 134 years there were 66 in which the rainfall was well conserved for the use of the tree.—(*Indian Agriculturist.*)

Seeding of Forest Trees.

Mr. G. A. Richardson, Divisional Forest Officer of Buxa, Bengal, writes that the present is a good seed year for Sal. Mr. Nallasawmy Naidu, Divisional Forest Officer of Bellary writes that in 1893-94 *Acacia arabica*, *A. leucophlœa*, and the tamarind seeded profusely. This year *Hardwickia binata*, *Bassia latifolia* and *Diospyros Melanoxylon* are expected to seed abundantly.

In the hills of Jaunsar an abundant crop of deodar seed may be expected in the autumn, and the *Pinus excelsa* is also likely to produce well. The 'Kharshu' Oak (*Quercus semecarpifolia*) has already shed its acorns, many of them actually in germination before falling from the tree.

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

6th June 1894.

East India Teak.—The deliveries for the first five months of this year amount to 5,311 loads, and are practically identical with those for the same period of 1893. In May 1,014 loads have been delivered as against 1,444 loads in that month last year. The depression in the ship-building trade remains unaltered, and has induced a disinclination to operate, on the part of buyers of forward cargoes. Governmental demand for war ships, and the spreading use of this wood for house building and general purposes are, however, counterbalancing factors, and at the present level of prices the future market should be fairly assurred.

Rosewood.—The demand is dull and stocks ample.

Satinwood.—For figury logs good prices are obtainable.

Ebony.—Small parcels of largo, good, logs wood realize fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superfical	6d.	to	12d.
Rosewood	„ ton	£5.	to	£8
Ebony	„ ton	£6.	to	£8

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, June 1894.*)

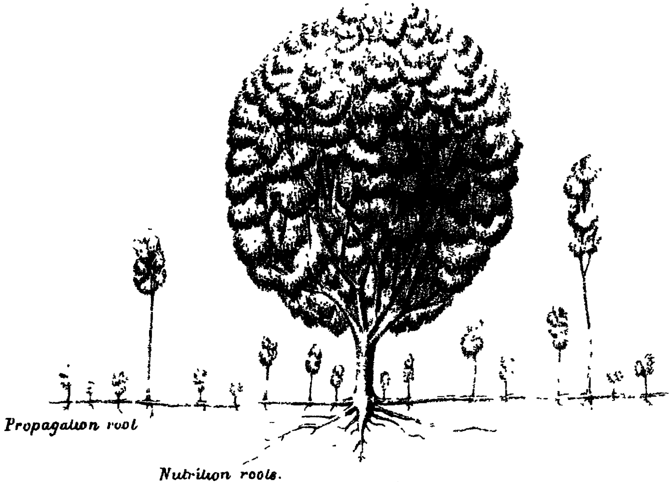
Cardamoms,	per ℔.	2s.	to	2s.6d.
Croton seeds	per cwt.	26s.	to	27s.6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	15s.	to	33s.
Gum Kino	„	£15	to	£18
India Rubber, Assam	per ℔.	1s.9d.	to	4s.2d.
„ Burma	„	1s.7d.	to	1s.11d.
Myrabolams, Bombay	per cwt	8s.	to	10s.
„ „	„	4s.	to	4s.6d.
„ Godavari	„	6s. 3d.	to	7s.
Nux Vomica, good	„	6s.	to	10s.
Orchella, Ceylon	„	15s.	to	22s.
Redwood	per ton	£3.10s.	to	£4
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	[illegible]	£30

16-YEAR OLD SONO-KLING TREE,

IN THE PROVINCE OF

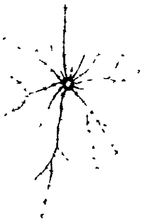
BANJUMAS, JAVA, TO SHEW ROOT-SUCKERS.

Fig. 1.



Scale $\frac{1}{2000}$

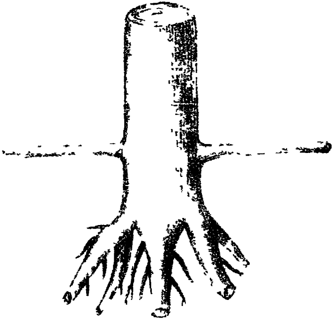
Fig 2



Scale $\frac{1}{300}$

Horizontal projection of the stem with propagation roots and 200 root-suckers.

Fig 3



Not to Scale.

THE
INDIAN FORESTER.

Vol. XX.] August, [No. 8

A Note on the Propagation of Blackwood or Rosewood

(*Dalbergia latifolia*)

IN JAVA.

BY S. H. KOORDERS.

(*Translated from the German.*)

On one of ridges of the low chain of hills, which intersects the district of Banjumas, in a locality called Gunung-Bantu, may be observed a small plantation of *Dalbergia latifolia*, known to the inhabitants as the Sono-Kling tree. This plantation is situated at about 250 metres above sea level, and consists of only a few hundred trees, which were planted in 1875-1876 by the State Forest Department. When I visited the spot in 1891, I observed that the trees were from 15 to 22 metres in height, and that every one of the trees originally planted was surrounded by a thicket of young stems of the same species. This young growth consisted, not of seedlings, but of root-suckers, and some of these root shoots had already attained a height of 9 metres, and were themselves propagating other suckers from their root system. It appeared to me that a more accurate knowledge of this peculiarity in the propagation of such a valuable tree would be most desirable, and I propose to communicate in this article the results of the observations made. I commenced by selecting one of the original 16-year-old trees, which possessed an unusually large number of root-shoots. The tree stood, as has before been noted, on a ridge some 750 metres above sea level; the soil was a stiff reddish-brown clay which becomes very dry and full of splits and cracks during the dry season, and yields, according to the statement of the inhabitants, only very poor crops. From the above description the discovery of a stratum of hard ironstone, at a depth of a few decimetres from the surface, will not be wondered at.

The selected tree was about 15½ metres high, with a diameter at breast height of about 0·60 metres. The stem was irregularly cylindrical, and was straight for about two metres, when it separated into four main branches, which formed a very dense crown covered with dark green leaves. This crown had a diameter of about 12 metres, and was shaped like a somewhat flattened sphere. The outside bark was dark grey brown in color; the sap wood was thick, white and without odour; whilst the black heartwood was almost wanting. The tree was covered with foliage, and the inhabitants of the place assured me that neither flower nor fruit had yet been observed in the plantation, whilst I myself could discover neither fallen fruit nor seedlings under the parent tree. It was even asserted that the original plantation was formed from root-suckers, as this was the easiest and surest way of propagating the tree.

The root system of the tree was remarkable. The roots extended over a large area, and were dimorphous: that is, one part of the root system served evidently for the nourishment of the tree and the other for propagation. The first mentioned had no buds, and consisted of the usual main root with numerous side branches and branchlets running into the soil. But besides this there were 10 or 15 other roots from 6 to 13 metres long, and some 5 to 10 centimetres in diameter measured close to the parent stem.

They, however, rapidly decreased in diameter, and at a few metres from the tree were only 5 to 10 millimetres thick, or about the thickness of an ordinary pencil. These roots were very tough and woody, of a dull yellow color, and they grew horizontally sometimes only a few centimetres, sometimes deeper, below the surface of the soil; in some instances they even lay on the surface. The roots were not strongly branched, but on the under side were provided with numerous hair-like rootlets, which grew perpendicularly from the horizontally extending main roots The horizontal roots bore numerous young shoots; sometimes on a root of one metre long and five millimetres diameter there would be five such shoots; in other instances, there was no young growth on several metres of horizontal root; but, speaking generally, there were from 16 to 200 young shoots for each tree of 16 years' old. The propagation root system of the selected tree having been dug up, the following results were obtained:—

I.—The tree had in 16 years produced 200 young shoots.

II.—The most distant shoots were 13 metres from the parent stem, and there had reached a height of two metres.

III.—Seventeen out of the 100 young shoots were over two metres in height.

IV.—The largest of all was 9 metres high, with a diameter of 8½ centimetres, and this stem, besides having a perfect root system for the nourishment of the tree, was throwing out side-roots in preparation for propagation by root-suckers. The original parent root, as thick as a pencil, from which this young tree had originally sprung, was still in connection with the young tree, although it was evident that the latter was quite independent of the parent stem, as was proved by the string root system of the new root-shoot and the want of growth in the original parent root.

V.—The sapling of 9 metres in height stood at a distance of 10 metres from the parent tree.

VI.—Some 25 young shoots were suppressed by thick growth of short grass* which covered the ground around the parent tree, but all the other young trees had grown up in a young plantation of *Cassia florida*, which had been formed on the other side of the parent tree, and in spite of the poverty of soil increased by the net-work of roots of the latter species, which intersected the ground in all directions, all the other root shoots of *Dalbergia latifolia* were flourishing. The three accompanying sketches are explanatory of the position. The *first* shows the parent tree with its root system for nourishment and two propagation roots. The *second* gives a plan of this latter root system, whilst the *third* illustrates the extraordinary development of the nourishing root of a 9 metre high young tree.

Another of the originally planted trees gave measurements of 22 metres high and 36 centimetres in diameter at breast height.

The above observations tend to show that *Dalbergia latifolia* possesses, besides its value as a timber tree, peculiar properties as regard powers of propagation.

I.—The tree is content with a stony, poor and dry soil.

II.—In such unfavorable circumstances (at an elevation of 250 metres above sea level) the tree attains in sixteen years a height of from 15 to 22 metres with a diameter of from 36 to 60 centimetres.

III.—The tree can be propagated without attention to sexual development by root cuttings and shoots.

IV.—The natural propagation by root-suckers is so rapid that in fifteen years a tree will be surrounded by vigorous young shoots, themselves capable of further propagation by their roots. But a ground covering of short grass is not favorable to the development of the young root-shoots.

V.—The peculiarity of the tree to cover from one parent stem in sixteen years a ground area of 500 square metres with young shoots, adapts it markedly for use in filling blanks, for each individual tree within that period would form a thicket of the species around it, and the cost would be considerably diminished, with a certainty of success.

---

*(*Translator's Note*).—More probably by the shade of the parent tree: *See sketches.*

Whereas in those species, which do not throw out root-shoots, it would be necessary to put three plants into 1 square metre, it would be sufficient in the case of *Dalbergia latifolia* to plant one tree on 10 square metres of land, the cost being then 30 times less.

It is evident, therefore, that the cultivation of the Sono-Kling tree is worthy of consideration not only by Government, but also by owners of private forests.

I.—Because the tree is easily propagated without much expense.

II.—Because it flourishes in a poor soil.

III.—Because it furnishes a very valuable and beautiful cabinet wood, which in its wild state is becoming rare in Java, and whose export to Europe promises to be a pecuniary success.

I only observed the *Dalbergia latifolia* as a forest tree in Central and East Java in poor and dry soils, at a not greater elevation than 300 metres above sea level, and for this reason such situations are specially recommended for the cultivation of this tree.

A much commoner tree in Java is the so-called Sono-Kembang, *Pterocarpus indicus*, which, however, does not throw out root-suckers. The Forest Department in Java does not yet possess complete herbarium specimens of the Sono-Kling tree, the two varieties of Sono trees, *viz.*, the Sono-Kling and the Sono-Kembang are, it is certain, totally different in form of leaf, habitat, color of the wood, etc., although both belong to the Leguminosæ, and for the correct determination of the two species I am indebted to Dr. J. G. Boer, Conservator of the Royal Herbarium at Leyden.

S. H. KOORDERS.

Failure of Natural Reproduction in the teak forests of the Coimbatore District.

The hope that the complete protection of the forests containing teak, situated on the Anaimalai Hills of the Coimbatore District, Madras Presidency, would secure a sufficient number of seedlings of that species, and of the more valuable of its companions, *Dalbergia latifolia*, *Pterocarpus Marsupium*, *Lagerstrœmia microcarpa*, *Xylia dolabriformis*, to ensure the regeneration of the Forest by means of a natural and improved regrowth, has not been realised. For, in spite of the fact that a very considerable area in these forests has been completely protected from fire and grazing for the last 12 or 14 years, the number of seedlings of the above mentioned trees is not greater to-day than it was 14 years ago. The number of seedlings of inferior trees, and especially of *Grewia tiliæfolia* and *Anogeissus latifolia* has slightly increased, and there is no doubt about the crop of grass, *Helicteres Isora*, *Acacia pennata*, *Cæsalpinia Coriaria* and other malignant under-growth, which is magnificent and impenetrable. The reasons for this are not far to seek, as when protection was commenced the leaf canopy was not only broken, but the forests were so open that they resembled forests in which the secondary fellings had taken place, with this difference that there was no crop of seedlings covering the ground, which was hard and unsuitable for the reception and germination of seeds, more especially of teak. The excess of light was in every way favourable to the growth of the noxious stuff mentioned above, and when this undergrowth was once established, there was no chance for any unfortunate seed which might manage to germinate. In parts of the Tekadi leased forest a certain number of mature and back-growing trees (all too old to coppice), have been worked out during the last eight or ten years, under a system of selection fellings. But for the reasons mentioned above, these fellings have neither improved the existing stock nor assisted reproduction, and they had still further decreased the number of seed bearers. These particular forests (Punachi, Tunacadavu and Tekadi) are situated on tablelands 1,000 to 3,000 feet above sea level, composed of a succession of low undulating hills ; the soil is deep and rich, and they are subject to the south-west and part of the north-east monsoons. From all accounts, their condition is very similar to the Wynaad forests in Malabar and to the Mudumalai * forest in the Nilgiris, except that as the rainfall is greater in the two latter districts, the chances of natural reproduction, owing to a denser undergrowth, are probably less. Cochin and Travancore both possess similar forests, and it would be interesting to know whether the officers in charge have arrived at the same conclusions as myself, which are briefly as follows :—

(1). The reason so few seeds, and especially teak, germinate, is that the soil, owing to the open condition of the forest, has become baked. The consequence is that the seeds lie on the surface, and those which are not eaten by insects, birds, rats, squirrels, &c, decompose. This can be proved by raking up the soil under or quite close to seed-bearing trees, just before or just after the seeds fall, a regular nursery being the result ; so also in cultivated patches, and to a lesser degree in damp places where earthworms are at work.

(2). The reason that so few seedlings survive is attributable to the dense undergrowth (8 to 10 feet high) of bushes, grass and thorny creepers, which spring up, and also to the open condition of the forest.

(3). Protection from fire has benefited in a certain degree the existing stock of mature trees, as it has prevented further scorching, but it has done no good in the way of natural reproduction, as it has only encouraged the growth alluded to above.

---

* The natural reproduction in Mudumalai is not bad in fire-protected areas

(4). The exclusion of cattle has done harm, as cattle would have kept down the grass and undergrowth. In a small area in the Tekadi Leased Forest, which has been heavily grazed by the bullocks which work the forest railway, the condition of the forest, so far as a tree regrowth is concerned, is distinctly better than it is in the area not grazed over.

When I say that the exclusion of fires and cattle has done no good, I refer only to these particular forests, or to others which may be similarly constituted and situated. The majority of the Madras forests have derived enormous benefit from protection.

In order to provide for the regeneration of these forests, the undergrowth must be removed, and the ground loosened. To effect this in the cheapest and most expeditious manner is what must be done; and probable financial results should be at any rate roughly calculated before any considerable sum of money is laid out; it would be folly to attempt methods which will not pay. The cheapest way would probably be to encourage heavy grazing (light grazing would have little effect on the grass and bushy undergrowth, it is so dense) in selected blocks or compartments for a year or two, this followed by protection would produce a certain number of seedlings. Another way would be to follow the Burma plan, and induce the Mulcers and other forest tribes to clear and cultivate the land, at the same time making them sow seeds or put out plants with their crops, this would require a range officer with considerable tact, as the forest tribes are indolent, and it is not easy to get them to do regular work. Where the ground is sufficiently free of undergrowth, loosening the soil with rakes and sowing broadcast would succeed. Clearing narrow lines through the jungle and sowing seeds, or putting in plants does not answer, as the lines soon become covered over by the adjoining grass and bushes, and the cost of constantly cleaning these lines is prohibitive ; cleaning the undergrowth and sowing in patches answers better. Loosening the ground underneath the trees just before or after seeding succeeds very well, but is not sufficient, as the forests are so open that spaces between the trees require filling up. If seeds are sown they should be put in during February or March, so that they may get the benefit of the April and May showers, the seedlings or at any rate a certain proportion of them, will then be fairly started by the time the south-west monsoon begins in June.

H. J. PORTER.

The Cure of Snake-bite.

I take the following extracts from a book I have just been reading, namely, "Travels in India a hundred years ago, with a visit to the United States, being Notes and Reminiscences by Thomas Twining, a Civil Servant of the Honourable East India Company, preserved by this son, Thomas Twining of Twickenham, and edited by the Rev. William H. G. Twining, Vicar of St. Stephens's, Westminster, with Portraits, Map——London, James R. Osgood, McIlvaine and Co.——1893.

"The couvre-capelle above described was apparently five or six feet long, and about as thick as a man's wrist. This snake is the most dangerous and destructive one in India, being the most common and the most domestic, that is, seeking houses where it secretes itself in the holes and chasms of the mud walls, in the thatched roofs, or under the hollow terraces. Its bite is fatal in a few hours.

"At a later period, when in charge of a district containing a great population, upon which it was my duty and, I may say, my earnest desire to confer the little good in my power, I had many most distressing opportunities of observing the dangerous qualities of those snakes, but I had also the satisfaction of saving the lives of many persons bitten by them. * * * These persons were brought to the door of my residence upon charpoys * * * or, in near and recent cases, were led, resting upon the arms of two of their friends. They were in different stages of the dreadful affection, according to the time which had elapsed since the accident had happened. All seemed to suffer extreme physical depression; many were speechless, some lock-jawed. in some the spark of life was scarcely perceptible, in some it was quite extinct * * * * But in almost all cases, where life remained, it was eventually preserved by the following simple preparation, communicated to me by a medical friend, who had experienced its success:—

"*Nassauda* (*Sal ammoniac*) one *seer*, fine *chunam* two *seers*, water six *seers*, distilled in the way practised by the natives in making their rose-water.

"To effect a cure, give a full-grown person from sixty to eighty drops in about double the quantity of water; if this does not produce sickness at the stomach in ten or fifteen minutes, give about two-thirds of the same dose every two or three minutes until sickness is produced. When the person has once retched, whether by the first or second dose, give again about one-half or two-thirds of the first quantity, and repeat it in the same manner until it makes him sick a second time, when the cure will be complete.

"The great object was to produce vomiting: when this was effected the recovery of the patient was almost invariably the consequence; but where the sufferer was too far gone for the liquid to be administered or to act, death was the certain result. I always had a supply of the medicine ready at my house, and also at the public Cutcherry or Treasury, where my offices were, and where Mr. Cock resided, to whose willing co-operation on these painful occasions, I, and more especially the natives, were much indebted. Our efforts scarcely ever failed where the arrival of the person had not by necessity or negligence been delayed too long. * * One day a respectable man of about thirty, one of the ryots or cultivators of my district, arrived in a dooley * * from a village about eight miles off. The man in the dooley had the appearance of a corpse, and was in the usual position of one lying upon his back, his head resting upon a low pillow, his hands straight by his side, and his naked knees bent up. I desired him to be brought into the shade of the verandah at the bottom of the great stairs, and went down to him with a bottle of the mixture. At the same time I sent to the Treasury requesting Mr. Cock to come. I do not recollect for certain what species of snake it was that had bitten the man, but I believe it was a couvre-capelle. I always desired that the snake when killed might also be brought, but this was seldom done. I found the man alive, but speechless and insensible. Such a state in an European would perhaps have appeared desperate; but I had had numerous opportunities of observing that the insensibility of a native of India in such cases was often as much the result of his natural resignation and extraordinary indifference to death as of physical exhaustion. It was evident, however, that more quick and decisive measures than usual were necessary to save him. I therefore ordered my servants to force his mouth open, and to pour down his throat the usual quantity of the mixture, but almost pure. I hoped that its scalding in this state might revive him, and render him more sensible to its intended action. The first effect was at once visible. He felt the burning pungency of the strong liquid. Thus partially revived, we gave him, after a few minutes, a further quantity more diluted, and now anxiously awaited the important symptom decisive of his fate. His stomach became affected, and I had the satisfaction of announcing to his friends that he was saved. The next day he was able to return home, complaining merely of weakness, and of the excoriation of the throat, as all my patients did, but which a decoction of linseed or other emollients removed in a few days.

"I had such proof of the efficacy of the above treatment during the last year that I remained in India, that I intended establishing depots of the mixture or of the materials composing it, with instruction for its preparation and use, in the principal towns and villages of my district; but the necessity of returning to Europe on account of my health prevented the execution of this design, as well as some other plans likely to be beneficial to the population under my charge. Had this further trial succeeded, I intended to propose it to the Government for general adoption."

I am no chemist, and have no book on chemistry by me, but I presume that the combination of chlorine with ammonia, or of hydrochloric acid with ammonia—the dictionaries at hand seem to think that either of these combinations is "Sal ammoniac"—does not lessen the power of ammonia as a stimulant, and that therefore *Sal ammoniac* would act as a stimulant equally with *Liquor ammoniæ*, the antidote usually administered in cases of snakebite. But the point I wish to draw attention to is, that Mr. Twining, on the recommendation of his medical friend, administered a solution of *Sal ammoniac* as an emetic, and that he says nothing, directly, as to the stimulating effect of the medicine. The great object, he says, 'was to produce vomiting: when that was effected the recovery of the patient was almost invariably the consequence.' But in the case of which he gives particulars, as the patient had been brought from a distance of eight miles, and was in a collapsed state he forced down his throat the usual dose, but almost undiluted, hoping that the scalding effect might revive him and render him more sensitive to the intended action of the medicine, namely, as an emetic. The burning pungency of the strong liquid partially revived the man, and he was then able to take the usually diluted dose, which produced the vomiting which Mr. Twining called "the important symptom decisive of his fate." On referring to an old Edition of Moore's Manual of Family Medicine for India, the only medical work at hand, I find that sickness, and probably vomiting, are said to be effects of snakebite, while it is not said that the administration of *Liquor ammoniæ* or *Eau de luce* is ever followed by vomiting: that antidote is administered simply as a stimulant, and to produce reaction from the depressing effect of the poison. I may, therefore, assume that *Liquor ammoniæ* does not act as an emetic,—indeed I know from experience that it acts as a sedative: in fever and ague a tea spoonful of *Sal volatile* in water may make one comfortable in a few minutes.

In the course of a long residence in India, I have never read or heard of *Sal ammoniac* (*nassauda*) being used as a remedy for snakebite, and, as an antidote to that calamity is still a desideratum, I think it worth while to bring Mr. Twining's experiences to notice, with the view of eliciting information and inducing experiment; and I do not think I could choose a better medium for doing so than the *Indian Forester*, as snakes are to some extent "forest produce," and forest officers must be, as much as any other Government servants, in the way of meeting with cases of snakebite, and must therefore have many opportunities of treating them. Should the *Sal ammoniac* mixture be found effective, a stock of it might be kept at Forest *Chaukis* and *Bungalows*, as well as at every *Tehsil* and *Thana* in India.

I have omitted to allude to the admixture of "fine *chunam*" with the *Sal ammoniac*, in the proportion of two to one. If this means quicklime, perhaps it is the internal slaking that produces the vomiting.

I have myself seen only one case of snake-bite during upwards of 34 years' residence in India, and that was not far from Sasseram, in Shahabad—Mr. Twining's head-quarters. I was in camp, with a brother canal officer, when a man was carried to us, apparently far gone. His friends said he had been bitten by a *karait* in his house, and a small wound on the sole of his foot was shown to us as the bite. The man was sometimes convulsed and insensible. We had no ammonia in camp, but administered about one-third of a bottle of brandy (or whiskey, I forget which) somewhat diluted, in several doses, and caused the man to be kept on his feet, and dragged about. Half the village was round us,—the elders calling on all their gods for help. They evidently believed it was a genuine case of snake-bite. Within half an hour the man was so much better that he was taken home, and next day he came to the camp, and returned thanks to us for having cured him.

C. W. HOPE.

MUSSOORIE,
16*th July*, 1894.

The Preferences of Lightning.

(*From the Revue des Eaux et Forêts.*)

It is well-known that under similar conditions lightning does not strike trees of all species impartially. Accepting this as a fact, observations have been made, with a view to obtaining more definite information on the subject. These observations, which extended over a period of fifteen years, were carried on in a large forest composed of 11 per cent. oak, 70 per cent. beech, 13 per cent. spruce and 6 per cent. pines.

During the period above mentioned 159 oaks, 21 beeches, 20 spruce, 59 pines and 21 trees of other species were struck by lightning, that is to say, taking equal numbers of trees of each species, for one beech there were 48 oaks, 33 pines and 5 spruce struck. This shows that the oak is especially attractive to lightning, whereas the beech is, comparatively speaking, unharmed by it.

Attempts have been made to explain this phenomenon as being due to the difference in the form of the crown of the two trees, that of the oak being more or less pyramidal, whereas that of the beech has a tendency to become spherical. This explanation is, however, hardly sufficient, as this difference in form of the crowns is not often very noticeable in trees which have grown up together in close canopy; and, moreover, in the above mentioned cases, the electricity left the tree much oftener by the trunk, than it did by the crown, *i. e.*, in 197 cases against 78.

Another explanation, more rational than the above, is that which, in accordance with the theory of electricity, attributes the preferences of lightning to the different conducting powers of woods of different species. This explanation, which until recently was nothing but a simple hypothesis, has been verified by experimenting on the resistance offered by different woods to the passage of an electric spark. A report on the results of these experiments has recently been submitted by M. Jonesco Dimitric to the Society of Natural Sciences of Wurtemburg.

Pieces of the same shape and size taken from the sapwood of trees of various species were subjected to the action of a Holtz electrical machine. At the first or second turn of the wheel, the spark passed through the specimen of oak ; twelve to twenty turns were required for beech, five for poplars and willows, &c., &c. Pieces taken from the heartwood of the different species gave absolutely similar results.

It was next ascertained that the proportion of water contained in the specimens had no influence on the conduction, but that the presence of a greater or less quantity of fatty matters in the tissues had a preponderant effect.

Species, of which the wood contains a large quantity of starch, like the oak, poplars, willows, maples, elms and the ash offer much less resistance to the passage of an electric spark than do those of which the wood contains much fatty matter, like the beech, the lime and the birch. The Scotch pine, which is impregnated with oily substances during the winter, contains very little of these in summer, and the wood of this tree was found to be a bad conductor during the former season and a good conductor during the latter. Another proof, yet more conclusive, is that the wood of the beech deprived of the fats which it contains, by means of ether, offers no more resistance to the spark than does the wood of the oak.

In conducting the above experiments it was found at the same time that the bark and leaves of all trees, irrespective of species, were bad conductors, and that dead or dying trees were in all cases better conductors than trees in their full vigour.

From the above it follows that if shelter is sought in a forest during a storm, it is safer to choose a tree of which the wood is rich in fats, it will afford relative, though not absolute, security from lightning, for when the electric tension becomes too great the spark, a flash, will escape by any tree of no matter what species.'

A. F. G

[We print this in continuation of an extract which we gave at page 241 of the present Volume. We are unaware of any observations made in this country, but we have noticed that in the N.-W. Himalaya, blue pine and deodar seem to be more struck than the broad-leaved trees which accompany them—Hon. Ed..]

Tannin in Indian Oak Barks.

Oak bark has been used for a very long time as a tanning agent in England, and the bark is obtained from the *Quercus Robur*, under its two forms *pedunculata* and *sessiliflora*. In America, the black oak bark is used for similar purposes, and is procured from *Q. Cocoinea var. tinctoria*, Gray, growing in the woods of North America as far west as Minnesota and Texas. The amount of tannin in European oak barks is given by Professor Procter as between 10 to 12 per cent. Weiss, a German chemist, in 1885, examined 15 commercial specimens of oak bark from Hungary, Germany, France, Denmark and Sweden, and the mean percentage of the tannin, calculated on the absolutely dry bark, was 13·5. In 1878 Eitner examined the barks of the two sub-species of British oak at different times of the year, and his results seemed to point to the conclusion that during the months of May and June, the barks yielded a larger quantity of tannin than at other times of the year, and that the *pedunculata* was always richer than the *sessiliflora*. The tannin in the American oak barks varies from 3·91 to 14·21 per cent., according to Professor Trimble of Philadelphia. The tannin from these species of oaks is said to be identical, and is called *Quercitannic Acid*, but in the barks the tannin is accompanied with colouring matters, which differ very widely from one another.

Professor Trimble is the author of a work on "The Tannins," which has already formed two volumes, and as he has been studying the history and chemistry of English and American oak barks, he wished to compare their value with the barks of the oaks which grow in the Himalayas. At my request, Mr. A. E. Wild of Dehra Dún kindly forwarded to Philadelphia the barks of four species of Indian oak, named as follows:—

Quercus annulata	(Inai).
„ *incana*	(Ban).
„ *dilatata*	(Moru).
„ *semecarpifolia*	(Karshu).

The amount of tannin in these barks was estimated by the "hide-powder" method. Powdered or rasped hide was originally proposed by Sir Humphry Davy, and was adopted as a satisfactory method by Karl Hammer in 1860. A solution of the tannin material is first made with water, and the specific gravity of the liquor is taken. The liquor is then digested with some hide for a few hours, filtered, and the specific gravity again taken. The loss in specific gravity on account of digesting with hide represented the tannin; a loss of ·004 indicating one per cent.

Professor Trimble obtained the following results upon examining the Indian barks:—

	Tannin in air-dried bark.	Moisture.	Tannin in dry bark.	Ash in dry bark.
Q. annulata	11·37	6·85	12·20	11·30
„ *dilatata*	7·40	6·88	7·94	10·02
„ *incana*	22·12	5·31	23·36	11·06
„ *semecarpifolia*	7·99	7·04	8·60	10·88

The tannin from the last named bark was purified and submitted to combustion in order to obtain its ultimate composition. It contained :—

Carbon	...	60·15.
Hydrogen	...	5·19.
Oxygen	...	34·66.

The similarity in behaviour towards reagents indicated that the tannins from these four barks are identical with one another, and with that from several species of oaks indigenous to America recently investigated by Professor Trimble. The ultimate analysis of the tannin from one of the above sample confirms the opinion that in them we have a tannin identical with that from other species.

The amount of tannin in two of the species exceeds the amount found in the American oaks, while that in the other two is equal to the average tanning capacity of those barks. The bark of the *Q. incana* is much higher in tannin contents than any European oak, and it would, from these results, be a matter of great interest to know if Indian oak barks could not be used more extensively for tanning purposes in this country than they are at present.

D. HOOPER.

[*Note.*—We have also received, from Mr. A. E. Wild, a copy of a paper on the same subject, by Mr. H. Trimble, published in the 'American Journal of Pharmacy' for June 1894. Ban oak bark could probably be supplied in considerable quantity, say, at Cawnpore, but the difficulty would be the cost of freight from the Hill Forest.

HON. ED.

II.—CORRESPONDENCE.

The Forest Department in Madras.

DEAR SIR,

Your article of the Madras Annual Report for 1892-93, coupled with the "Rules for the training of Junior Assistants in Madras," also published in your May number, show plainly that the tendency in this Presidency is to bring the Department on to the same level as the "Salt and Abkari," in which rules are laid down for the manner in which work is to be done during twelve hours per day and 11½ hours per night. Conservators are rapidly being reduced to ornamental nonentities, whose abolition, if the present system continues, is merely a question of a few years' time.

They have no power, either financial or administrative, their work being limited to the inspection of forests, with *permission to advise* Collectors; they are not allowed to prepare annual reports for their Circles, and they have no powers to sanction expenditure. The District Forest Officer is no longer a trained man under a trained Conservator, working the forests in his charge for their benefit, subject to the approval of a trained Conservator, but a machine carrying out the orders of the Collector and the Board of Revenue, and preparing reports and tabular statements *ad lib.* If, while on tour he comes across a piece of unforeseen work, which he wishes to personally superintend (*e.g.*, the correction of a boundary line, the preliminary trace for a road, or the marking out of compartments) he must first sit down, estimate the cost of the work, even if it be only Rs. 2, and obtain the sanction of the Collector.

The Salt and Abkari Department is very perfect in many ways, and all praise is due to the able officer who made it what it is, but if the Forest Department is to be managed in the same way, why should its officers have to undergo a long and expensive training before they can join their appointments? No member of the Board of Revenue would attempt to dictate to an Engineer what should be the depth of a girder, or how much waterway was necessary for a certain stream, but for Forest Officers, the law is laid down on all points, and yet if a three years' course of training is necessary for Forest Officers, it is evident that there must be technical points in their work which no untrained man can master in one or two or ten tours of inspection, the real object of which is to see how much more revenue can be received out of the forests, and how many more returns and reports can be extracted from the Forest Office, to further (in your words) "the compilation of records to give honor and glory to a member of a Board of Revenue."

The Forest Estate of the Madras Presidency is one of great value, it requires nursing, strengthening and developing, operations to which Forest Officers have but little time to devote, owing to the heavy office work they are burdened with, but operations which trained officers, properly supported, are alone competent to carry out, and which cannot be regulated by rules drafted in arm chairs in Madras.

MADRASSEE.

Promotion in the Bombay Forest Department.

SIR,

As a covenanted officer of the Bombay Forest Department I beg to enter a protest against the assertion by 'A Bombay Officer' in your July number that 'a strong feeling of discontent' exists in the Department on the subject of the extension of service granted to the Hon. A. T. Shuttleworth. Any 'feeling' there may be in the matter on the part of those officers of the Department who have the good fortune to serve under the Hon. Mr. Shuttleworth is, I imagine, of a precisely opposite kind. We know very well that we shall never get such another 'chief,' and some of us would be unfeignedly glad to hear that he would still be fighting our battles 5 years hence.

If we are to assume that the C. S. Regulations have any meaning at all, it is evident that the rulings under Sect. 503 (*c*) completely demolish the special pleading of 'A Bombay Officer's' two last paragraphs.

NANCEIEN.

SIR,

Allow me to emphatically deny the "strong feeling of discontent" alleged by "Bombay Officer" as to the extension (so-called) of the Hon. Mr. Shuttleworth's service. It is well known that one man is discontented, and another remembers that Mr. Shuttleworth once had occasion to evil-entreat him officially. I doubt if a third or fourth could be found, but if any more fuss is to be made, it will be easy to poll the Dept. by postal ballot. So much for sentiment, now for law. As the rules appear to me, Government has no choice in the matter, unless it likes to declare that Mr. Shuttleworth is mentally or physically inefficient. This step, I rather think, it will hesitate four or five years before taking. If Mr. Shuttleworth gets an extension (he did not ask for the present one) after he is 60, it will be time enough to protest.

I regret extremely that "Bombay Officer" has thought fit to raise such a question. It is quite true that we have great cause for discontent here in Bombay, but I would remark, as gently as possible, that those who are now in arms are, I think, precisely the men who have sat most *chup*, while others risked their skins in the battle.

ECLAIREUR.

SIR,

In the July issue of the *Forester* you have inserted a letter signed 'Bombay Officer,' stating that "a strong feeling of discontent exists among the covenanted officers of the Bombay 'Forest Department owing to the rumour persistently current, that 'an extension of service is about to be granted to the Hon. Mr. 'A. T. Shuttleworth, Conservator of Forests, 1st grade." I wish to contradict any impression that may be created that such discontent is at all general amongst us, that there is discontent amongst some officers, I know, but there are also a number of us, including most officers who are now serving, or have at any time served under him, who are not at all anxious to see Mr. Shuttleworth leave the Department; and who, in fact, hope that he will remain with us for some time yet. "Bombay Officer's" letter is apparently designed to prejudice Mr. Shuttleworth's chance of getting an extension. We, therefore, hope that the report is true that an extension of one year has already been granted. Mr. Shuttleworth has done splendid service for the Bombay forests—service that might well have been recompensed with the C. S. I. long ago. He has worked unselfishly in the interests of the Department, and has always been a true and loyal friend to every officer serving under him. We are, therefore, not all of us so ungrateful as to wish to see him compulsorily retired under the 55 years' rule ; more especially as under the rules applicable to him he can continue to serve, provided he is physically fit. Regarding this there can be no doubt. Mr. Shuttleworth is as vigorous and active as many men 20 years his junior, and as conscientious in inspecting the forests as any man in the service.

It is but too true that Bombay Officers are singularly unfortunate as regards their promotion, but that is due to the reduction of the number of our Conservatorships from three to two. This was principally due to the mistaken opinion of a Staff Corps Colonel, formerly Conservator, that the forests of Sind could be managed by native officers under a limited European supervision, and that a Conservator there was not required. We live in hopes of soon seeing that Conservatorship restored, and with it the creation of a fourth Conservatorship, doing away with the present anomaly of two circles in charge of Deputy Conservators who hold the position and powers of Conservators without the pay.

"Bombay Officer" in giving his examples of how unfortunately we are situated has omitted to mention the hardest case of all, that of Mr. F. R. Dasai. Mr. Dasai is the only member of the first batch of Nancy men now left in the Bombay service, and his rank is still only that of a first grade Deputy Conservator, and though he has held charge of the Northern Circle for 18 months he has never even acted in the grade of Conservator ! He has always worked well, and has had the commendation of Government, yet after 25 years of approved service he is still a long way from a Conservatorship. No parallel can be found for his case in any other service in India, though "Bombay Officer" has shewn but too truly how hard the block in promotion in Bombay has told on other senior officers on our list.

There can be no question of the "justice" of an extension of service being granted to Mr. Shuttleworth. Under the rules applying to him, it would be an injustice to make him retire at 55. I have not seen the new rules lately applied to convenanted officers of the Forest Department, but I have been a fair number of years in India, and I understood before I came out that I should have to go at 55, *nolens volens*. The question of a "breach of faith" on the part of Government need not be considered.

NANCY.

[NOTE.—We hope our Bombay correspondents will excuse us if we now allow this discussion to close.—HON. ED.]

III.—OFFICIAL PAPERS & INTELLIGENCE.

Re-issue of the Annales Forestières.

In our note on this subject on page 264 of the July *Forester*, we hardly made it sufficiently clear that the sets were not quite complete, and we have now been reminded that the following are missing:—

Revue des Eaux et Forêts	1864 to 1866
Répertoire de Legislation, etc.,	1863 to 1870

We were not quite right in talking of a 're-issue,' as the books really are the old issue being sold off, but remarkably cheaply, in our opinion, even with the omissions above referred to.

Is the Removal of Drift Timber a Forest Offience?

The following recent judgment of the High Court of Calcutta will be read with interest by those who are in charge of drift collection works.

RIGHTS OF A FOREST OFFICER.

"In the case of the Empress *vs.* Ashkar Ali, the facts of 'which have been reported, in which Mr. P. L. Roy appeared on 'behalf of the petitioner, their lordships delivered the following 'judgment, which deals with the facts of the case:—The petitioner 'Ashkar Ali has been convicted of an offence under section 224 of 'the Penal Code, and has been sentenced for such offence to four 'months' rigorous imprisonment. He has also been convicted of 'an offence under section 147 of the Penal Code, and he has been 'sentenced to three months' rigorous imprisonment in addition 'under that section. We are of opinion that the conviction cannot 'stand in either case. The offence which has been created by 'section 224 is the intentional offering of resistance or obstruction 'in the lawful apprehension of a person for an offence with which 'he is charged and of which he has been convicted ; and in this 'case it has been held by the lower courts that the petitioner, Ashkar Ali, resisted his lawful apprehension by one 'Mr. Barrett, Deputy Conservator of Forests, in the District 'of Cachar. The Assistant Commissioner, in dealing with 'this matter, has held that Mr. Barrett was entitled to 'arrest Ashkar Ali, inasmuch as he entertained a reasonable suspicion of his having been concerned in a forest offence, and the 'forest offence of which he finds that Ashkar Ali was suspected, 'was apparently the removal of drift timber from the banks of the 'river before payment of royalty. He holds that a suspicion of 'having been concerned in the theft of drift timber would not be 'sufficient for a conviction, inasmuch as the theft of drift timber 'is not a forest offence under the definition contained in the regulations. The Sessions Judge, on the other hand, no doubt, apparently considered this question very carefully, having held that 'Mr. Barrett had ground for holding that Ashkar Ali had stolen 'or dishonestly received forest produce, and he apparently seems 'to regard that the theft or dishonest receipt of forest produce is 'a forest offence under the regulations. The term "forest offence" 'is defined in section 3 of the Assam Forest Regulation by Regulation 7 of 1891. 'Forest offence' means an offence punishable 'under this Regulation, or any rule thereunder. The theft 'or dishonest receipt of drift timber is not stated to be an offence 'under the Regulation, and there is apparently no rule under which 'that could constitute a forest offence, and such a rule was, of 'course, unnecessary, inasmuch as it is an offence under the Penal 'Code. But turning to the finding of the Assistant Commissioner, 'we must refer to the provisions of chapter 7 of the Regulation, 'and under that chapter it does not appear that the removal of 'timber from the banks of the river without payment of royalty is 'a forest offence either under that chapter or under any rule made 'in accordance therewith. The chapter lays down that drift 'timber may be collected by any forest officer or other person 'entitled to collect the same, and brought to such station as may 'from time to time be notified. It then goes on to say that notice 'of the timber so collected shall be published and claimants invited 'to come in and substantiate any claims they might have, and that 'such timber which is unclaimed shall vest in the Government free 'of all incumbrances. Then section 47 provides that claimants 'entitled to recover possession shall not remove the timber until 'the royalty has been paid, and section 48 empowers the Local Government to make rules to regulate certain matters under this chapter, but none of the matters therein mentioned has reference to the 'removal of drift timber from the river by persons who are not 'authorised to collect it. It seems to us clear, therefore, under 'this regulation, that the act of removing the drift timber from the 'banks of the river before payment of royalty is not a forest offence, 'though, of course, as we have said, it may be an offence under 'the provisions of the Penal Code. Now Mr. Barrett's power of 'arrest is defined by section 60 of the Regulation, which runs as 'follows :—

'Any forest officer or police officer may without orders from 'a Magistrate and without a warrant, arrest any person reasonably 'suspected of having been concerned in any forest offence punishable with imprisonment for one month or upwards, if such 'person refuses to give his name and residence, or gives a name 'or residence, which there is reason to believe is false, or 'if there is reason to believe that he will abscond. Now 'we have already pointed out that there was no reasonable 'suspicion of any forest offence having been committed, and this 'section does not authorise Mr. Barrett to arrest the petitioner on 'a suspicion of having committed any other than a forest offence. 'Further, the power of arrest is limited by the concluding words 'of the section. Mr. Barrett was well aware of the name and 'residence of the petitioner ; he was in fact at the very time at 'the petitioner's residence, and considering the position of the petitioner and his father, it seems to us that there was no 'ground for that he was likely to abscond. Under these 'circumstances we think that Mr. Barrett had no authority 'whatever to arrest the petitioner, and that in resisting 'that arrest, the petitioner has committed no offence. That being so, 'we think that the conviction under section 224 of the Penal Code 'must be set aside. Then, as regards the offence under section 147, 'the judgment of the Sessions Judge is altogether silent. What 'the Assistant Commissioner says is this :—' It was quite 'clear from the evidence that there was riotous assembly, the 'common object of which was assault and forcible obstruction to 'public servants,' and the facts, as set out by him in the former part 'of his judgement, are as follows :— After Ashkar Ali had offered 'resistance to his arrest and had run inside his house, the Assistant 'Commissioner, says Ashkar Ali, began to shout out most abominable language, and cried out seize the *sahib* and take away the 'receipt. About a dozen men ran after Mr. Barrett, shouting out ''give back the receipt'. Mr. Barrett was pursued for some distance by the men, who however gave up chase. Now there is no 'finding here that Ashkar Ali was one of the parties who pursued 'Mr. Barrett, or assaulted Mr. Barrett. Apparently he remained 'inside his *bari*, and the mere fact that he called out to the others 'to seize the *sahib* and take away the receipt is not, we think, 'sufficient ground upon which we can say that he committed a 'riot. It seems to us therefore, that he was not properly convicted under section 147 of the Penal Code, and that this conviction also must be set aside. The result is that both convictions 'must be set aside, and the petitioner released.

IV.-REVIEWS.

Forest Administration Reports for 1892-93 for Ajmere, Berar and Baluchistan.

The AJMERE Report is noticeable for the record of an improvement in the conditions under which grazing is allowed. In 1891-92, almost the whole area was thrown open: in the year under review 43·6 per cent. of the total area was closed; and in the open portion grazing was only allowed for 4 months. The Government of India have expressed their satisfaction at this, and we may hope that the arrangement will continue, and that the young officers of the Ajmere Staff will understand that what they consider only grazing grounds are being converted into forest by degrees.

The chief item in the forest history of the year was the preparation, by Mr. Coventry, an Assistant Conservator, deputed from Berar, of a general scheme for the regulation of forest working, including grazing management; and this scheme, we hope, we shall soon be given an opportunity of discussing. The financial results of the forest year were:—

Revenue ... Rs. 13,323 } the deficit being due to
Expenditure ... „ 15,630 } the pay of the Assistant
Conservator on special duty.

The Berar Report is submitted to Government by Colonel Kenneth Mackenzie, the Commissioner, and as this is the last Report which he expects to review, he has recorded his opinions on the subjects of recruitment and departmental policy and history, and these we think it right to extract:—

"As Mr. Bagshawe points out in his report, there is very 'great difficulty in getting physically fit and suitably educated 'young men now to enter the Ranger's grade; and everybody, 'who is acquainted with the facts in the background, will agree 'that a potent cause for this is the comparatively poorer prospects 'that such men at present have in the forests, as compared with 'openings in other departments. Consequently it will certainly 'pay Government directly and indirectly to improve the position 'of the upper subordinate grade in the manner now before the 'Resident and the Government. I do not think that the hard 'work, the loneliness, the sickness that these men have to face, 'comes home in anything like the reality to those ultimately responsible for their welfare, as it does to those who, like myself, 'are locally more frequently and continuously brought into intimate relation with facts. As bearing on this question, I happen 'to be in a position to give exceptional evidence: for it fell to me, 'as Assistant Commissioner, in 1866, nearly 28 years ago, to select 'and demarcate our main reserves and to start under the direction 'of Colonel George Pearson, the Conservator at that time common to the Central Provinces and Berar—what is now the 'Berar Forest Department—and of all the men I then enlisted, 'though with one or two exceptions they were all young men of 'excellent physique and locally acclimatized, but two now survive—Misri Persad and Ahmed Ali.

'For a reason that will presently be apparent, I wish to 'record that our forest policy up to date has been to take up suitable areas for permanent reservation, and to work these up to a 'healthy condition by fire conservancy and general protection, and 'during the time requisite for this, we met the demands of the 'province mostly from the unreserved or open forest, which ultimately was destined, where not cultivated, to meet the demands 'of grazing. The result has been that the cost of administration 'was very cheap, and an abnormal surplus possible. Now that 'the unreserved areas are being worked out, and the permanent 'reserves are in a condition to be, and are being drawn upon more 'and more, the cost of working them must rise; for, in a permanent reserve, the cost of regulating forest operations naturally 'must be more costly than what, as above described, was previously the case. I think it is very necessary to recognize and 'bear this in mind, for a failure to do so might lead to a reduction of working charges, which would, I consider, undo the work 'of over 25 years, and would risk the future of a forest property, 'in the Melghat, of considerable and rapidly-increasing value.

'Intimately connected with the welfare of the forests is the 'prosperity of the people in and immediately around our reserves. 'Their well-being, on which follows their good will, depends on 'the wise adjustment of our forest concessions to their necessities. 'Luckily our position, especially in the Melghat, our chief forest 'tract, enabled us to be liberal, with the result that the people in 'the hill tracts are well affected towards us. They practically 'form an unpaid protective force, of great value, in addition to 'our own staff. Without their ready and willing assistance our 'great success in fire conservancy would have been impossible. 'I trust nothing in the future may cause a break in this policy.

'I have ventured to attract special attention to these points,' 'which I conceive to be of great importance, as possibly this may 'be the last Hyderabad Assigned Districts Forest Report which 'it may be my privilege to review, and because having been more 'or less intimately associated with the Forest Department from 'its start, I am naturally interested in its welfare. It fell to me, 'as Assistant Commissioner and Conservator in 1865-66, to make 'the first Hyderabad Assigned District Forest Report, when the 'forest revenue of the Melghat, then our only forest, returned for 'the year Rs. 25,000. The average of the Melghat forest revenue 'for the last five years has been Rs. 1,76,256 per annum. In '1890-91, a year of unprecedented prosperity, its revenue touched 'Rs. 1,99,875. The entire provincial forest revenue for the last 'year of the report now being reviewed, *vide* annual form 65, was 'Rs. 5,38,509, with charges amounting to Rs. 3,05,655, leaving a 'surplus of Rs. 2,32,854.

"Several officers have come and gone since the start, most of 'whom in their turn piled up the cairn of good forest work, but 'to none is the province more indebted for laying a good foundation 'tion on which the present rests—a foundation laid in critical 'times and in the face of considerable difficulties, from within and 'without, than two whom I would venture to name—Mr. Alexander 'Drysdale, who has retired, and Mr. John Ballantine, who 'is now on furlough in view to retirement.

"The present Conservator, Mr. Bagshawe, and the writer of 'the report, was himself formerly here for a time, and we are, I 'consider, lucky in obtaining his services again. The Resident is 'aware, from references that have gone before him on various 'points of importance since Mr. Bagshawe's return and assumption 'of charge, how very thorough and complete his work is, and 'how exceedingly I am indebted for the assistance he has so 'cordially rendered me, and which I am only too glad to thus 'acknowledge."

In other matters, too, Colonel Mackenzie's letter is very interesting. In regard to the question of pasture-feeding *versus* stall-feeding for cattle he says:—

"It can hardly be denied, I think, that the more extensive the 'area open throughout the year to pasturage, the greater the 'ability to maintain weak and useless stock, and the greater the 'difficulty of improving the breed. This ability, too, to let their 'cattle roam unchecked makes it impossible to effectively control 'cattle-disease, which in epidemic form is, we know, periodically 'so disastrous to agricultural interests. Therefore it seems to me 'that the true solution is to facilitate stall-feeding, and to restrict 'the areas open to indiscriminate grazing. The subject requires, 'however, to be dealt with gradually, cautiously and carefully. 'The hope for Berar, in my view, is, that already there is a good 'deal more done in the stall-feeding line than is generally recognized, 'or than is the case, I believe, in other parts of India. In 'the richest parts of Berar the people *nolens volens*, stall-feed the 'cattle actually in use—and here we find really some of the finest 'specimens of the breed, for which the province is noted."

And we note, with satisfaction, that the Government of India approve his remarks.

The Conservator has given a classification of the State forests, which is interesting. The forests are now being maintained and worked :—

	sq. miles.
For timber and fuel	1,322
„ fodder and high grass ...	63
„ pasture	1,598
(As yet unclassified)	1,250
Total ...	4,233

Fire protection was not very successful during the year, but there has been considerable improvement in forest growth, and the Conservator says :—

"In the Bairagarh and Gugumal Forests of the Ellichpur 'Division the advance in natural reproduction is most marked, 'Mr. Prevost in his report says 'in no previous year have I seen 'so many seedlings, while the saplings and poles of all kinds have 'made most astounding shoot, and in very many places the teak, 'tiwas and haldu poles present the appearance of a fully stocked 'plantation: speaking roughly, it may be said that in the past 'three years the forests have filled up and the advance growth 'closed up more than it did in the previous ten years.'

'The Commissioner, Colonel Mackenzie, visited many parts 'of Bairagarh that he had not seen for several years, and he also 'was much struck with the marked improvement now so very 'apparent. Personally I think the change that has taken place 'during the past ten years is most striking, whether we look at the 'general appearance of the forest or notice specially the teak, 'haldu or bamboo growth; and the present condition of natural 'reproduction in the Melghat reserves is a triumphant testimony 'to the soundness of the forest policy introduced, and for so many 'years persistently supported, by Colonel Mackenzie."

The financial results of the year shewed :—

Receipts	Rs.	4,31,835
Expenditure	„	2,49,527
Surplus ...	„	1,82,307

which, we suppose, goes to the Nizam.

In the *Baluchistan* Report there is much of interest, and especially interesting is Mr. Elliott's account of his tour in the Zhob District in the autumn of 1892. He found five points of special note, which we reproduce :—

"(1) The pistacio *P. Cabulica* (khanjak) forests in the 'upper part of the district, such as that in the Babu 'China Valley near its junction with the main Zhob 'Valley at Valtoi, Toi, and elsewhere.

(2) The sudden appearance of the olive a little above Fort 'Sandeman and its occurrence in pure forests over a 'large area in the lower part of the district.

'(3) The occurence in the east part of the district of large 'tracts of *Acacia modesta*, crossing a small range about '25 miles east of Fort Sandeman, which virtually 'separates the drainage flowing south-east to the Vihowa 'pass into the Punjab from that which flows north and 'west; the olive suddenly ceases and its place is taken 'by the "phulai" (*Acacia modesta*), which is found 'all through the Musa Khel country, down to the 'Anambar river at the east end of the Bori Valley. 'In one place on the summit of the dividing range 'just mentioned, some box was found, the only place in 'Baluchistan where it has been discovered.

'(4) The juniper is almost unknown in Zhob. It occurs 'at the west end in small numbers, and of stunted 'growth.

'(5) On two ranges, "Ghastoi" or "Speraghar," about 30 'miles north-west of Fort Sandeman, and "Shinghar," 'about the same distance to the north-east, there is an 'abundant growth of *Pinus Gerardiana*, a tree which is 'said to be carefully protected by the Pathans on account of its edible fruit; nevertheless, there is considerable damage by fire; the former named forest is poorer 'than the latter, which fact is probably accounted for 'by the position of the hills. Ghastoi, rising to 8,000 'feet, is isolated and has only lower hills near it; 'whereas Shingarh rises to 9,000 feet, and is parallel 'with, and at no great distance from, the Kaisar 'Suleiman Takht range, which being the highest in 'that part of the country, over 11,000 feet, catches the 'rain clouds, and doubtless a portion of the moisture 'reaches Shingarh."

Besides the above, the slopes of the Suleiman Takht are reported to be well wooded with what are said to be deodar, blue pine, *Pinus Gerardiana* and some juniper. It is rather disappointing to find that the Deputy Conservator's proposals to extend the Regulation at any rate to the olive forests near Fort Sandeman has met with no remark either from the Agent or from the Government of India. So, too, no remarks are made on the general question of the extension of the State forests area in Baluchistan, regarding which Mr. Elliott says :—

"Referring to the general question of extending the State 'forest area in Baluchistan. it must be remembered that as long as 'there are any trees outside the State forests, the people will cut 'those trees, and there is no demand for the produce of the State 'forests, so that every new forest reserved means an addition to 'the expenditure, for pay of establishment, without any corresponding increase in revenue. The fact, therefore, has to be 'faced that the department must work at a loss for some years, and 'that probably the deficits in the immediate future may be greater 'even than in the past.

'It is probable that the juniper has been overrated, and too 'high an estimate formed both of its present and future value. 'The juniper is not a good firewood, as it burns too fast and does 'not retain heat; the charcoal is also poor. As a building timber 'it is very unsatisfactory; knots and holes ruin even logs that outwardly appear sound. The value of the tree lies chiefly in its 'covering the ground, and forming humus, which will prepare the 'way for more useful trees.

'The policy to be pursued now is to protect strictly; the 'shrub jungle increases rapidly under conservancy; many of the 'bushes yield a good fuel, and when the ground has become fairly 'covered with shrubs, it will be possible to establish an advance 'growth of some better forest tree than juniper, and eventually to 'cut out the brushwood, which will yield a good revenue. Whether 'juniper grown under better conditions of protection from man 'and beast, of improved soil, and aided by a thick undergrowth of 'shrubs, will prove a more valuable timber than it is at present, 'is a question which cannot be settled for some time; probably it 'will improve, for selected pieces of mature wood are heavy, strong 'and durable. The substitution of good hardwood trees for juniper 'is however the object to be kept in view. The indigenous 'pistacio and fraxinus must be encouraged; and the introduction 'of *Robinia pseudo-acacia* on a large scale seems to offer the best 'hope and success with non-indigenous species."

We notice, however, that the Agent has called for a re-submission of the question of the reservation of the Torshor forest, which the Revenue Commissioner had negatived "on the grounds 'that the forest would not pay expenses, and that it was protected 'from damage by its distance from Quetta" on which the Deputy Conservator had remarked that if such reasons were expressed there would be hardly any State forests in Baluchistan.

Mr. Elliott mentions, as one of the arguments for the reservation of the olive forests near Fort Sandeman that the "charcoal 'supplied to the Commissariat was made by setting fire to green 'Olive trees and picking out any bits of charcoal that might remain 'in the ashes." We thought the ordinary Indian practice of burning wood in a pit and then picking out such pieces of charcoal as could be found was pretty bad, but this beats it completely.

The financial results of the year were :—

Revenue	... ...	Rs.	19,037
Expenditure	... ...	"	55,626
Deficit	...	"	26,701

which is a falling off on the previous year.

'Studies in Forestry'

This work consists of short series of lectures arranged so as to form a handbook of British Forestry, and as such it will prove of considerable value to those in charge of woodlands in Great Britain, who have, apparently for the most part, never received any technical training, having acquired such knowledge of forestry as they possess by experience, purchased presumably at the expense of their employers and amplified by the very few books available in their native language. The opening chapter is devoted to a consideration of the position as regards forestry in Great Britain. The value of State and Private forests is calculated, and it is asserted that while Government acknowledge the importance of technical training, they go no further in the matter than to appoint commissions of enquiry whose recommendations, even when of the most modest, are not attended to. It is also shown that the arrangement made for training Indian Forest Officers at Coopers' Hill College so improved the financial condition of that Institution that the annual deficit became a surplus, proving that the charge to an individual for the only technical training in forestry to be had in Great Britain is excessive, even if it were not a matter of common sense to perceive that the classes in England, who wish to profit by such training, are not in a position to disburse the £700 or £800 necessary to defray the cost of the 3 years' training. The author concludes the chapter by suggesting, as is only fair, a remedy for the present state of affairs, whereby at a cost of about three-quarter pence per acre for the area under timber, on the system adopted at educational centres on the Continent, the United Kingdom might be provided with the best educational advantages in forestry open to all at a small cost. We can only hope that this suggestion will in time become an accomplished fact, so that the reproach may be removed which at present rests on England as a nation, in regard to its apathy and ignorance in matters sylvicultural.

The remaining 13 chapters of the book lead the reader simply and progressively, after briefly describing the British Sylva, to a position whence he should be prepared, in any given circumstances, to decide what species to cultivate, how to form his woodland crops, how to tend them when he has them, how to manage them in the most paying manner and how to regenerate them when the necessity arises. The two last chapters are devoted to a consideration of some diseases of trees and of a few of their insect enemies.

To those who are unable to refer to the standard German works on the subject touched in this book, Mr. Nisbet's 'Forest Studies', will be valuable. And those who can do so may yet be glad to have the opinions of the greatest authorities in sylviculture, and some results of their observations collected in a

---

'Studies in Forestry,' by J. Nisbet, D. &c., Clarendon Press Oxford.

concise and convenient form. It is not supposed that the author lays claims to any originality of research in regard to British sylviculture, the fact of his belonging to the Indian service would preclude the possibility of continuous practical study of forestry in Europe, so that while acknowledging the value of this work to the British forester, we can only selfishly regret that the studies in forestry were not the outcome of Mr. Nisbet's knowledge applied to the Sylva of India.

Field and Garden Crops.

We have received from the Director of the Botanical Dept. in Northern India a copy of Part III of his Field and Garden Crops of the North-Western Provinces and Oudh. The first two parts dealt with the principal food crops and the vegetables, and the present one completes the work with descriptions of the miscellaneous food plants and food adjuncts. Plates are given of all the species described, and the descriptions give the chief items of information regarding them. In some of the plates the dissections are not very good: witness the section of a *brinjàl* in plate 95, but the figures themselves are excellent. The work, as a whole, is an invaluable one to those who wish to study the various crops of different plants of Northern India, and to know something of our common native vegetables; and we congratulate Mr. J. F. Duthie on its successful completion.

VI.—EXTRACTS, NOTES AND QUERIES.

The Physical Test for Candidates for Coopers Hill.

Many of our readers will be amused at the following extracts of letters received by a correspondent from a candidate for the recent examination of the Forest Department through Coopers Hill:—

"On June 22nd we had to be at the India Office at 11. A. M. 'to meet the Professor of Forestry; and the Medical Board sat at 1 'P. M., but we were not allowed to leave as soon as examined. 'We had to wait till all had been examined, and the Professor told 'us the result collectively. Of those, 26 in number, who were exa'mined on Friday (23rd July) none failed. Thirteen were examin'ed on Tuesday, and of those one or two failed. Altogether there 'are 39 up this time. One at any rate was ploughed in the 'Medical, and perhaps two in the Physical, as they were not pre'sent at the end when their names were read out.

"I am just back from the Physical. I got along splendidly, 'no blisters or split nails or skinned feet, though the soles of my 'feet were a little sore owing to the hard ground. A profes-'sional walker came with us this year, and I think this was the rea-'son that he took us faster than last time, when one of the professors 'came too. We did the first twelve miles in 2 hours and ten minutes. 'then stopped for lunch, and started again at a quarter past one, 'getting back to Jack Straw's Castle by a quarter past four. The 24 'miles took altogether 5 hours, 10 minutes, a pretty smart pace at any 'time. It had been a hot day, but a breeze has, luckily for us, been 'blowing all day. We had to get over innumerable stiles, and at 'each there was a rush to see who could get over first. It was a 'very foolish proceeding, but I had to do the same, or else be left a 'good way behind. I felt quite fresh for the first twenty miles, 'but after that began to feel it a little, but I was not nearly so tired 'as last year. Towards the end I felt cramp coming on, and 'was just deliberating whether I should fall back a bit and rub 'my leg when some one else very kindly obliged me by taking it. 'This necessitated a stop, of which I took full advantage by rub-'bing my legs. He had taken it pretty badly, and the profes-'sional took 5 minutes to rub it out of his leg. When two miles 'from home a second fellow took it very badly, and though he 'was soon able to walk on, he felt his legs very painful. These 'two stops helped many of us, and I came in at the end compara-'tively fresh. After a wash up I felt all right, and not very stiff, 'Then we had tea, and that was the end."

Kamela Powder.

It does not seem to be generally known that this powder which is usually obtained dry by rubbing it off the capsules of *Mallotus philippinensis*, can also be obtained by a wet process ; and that the extract is commonly prepared in the Dún. In the wet process, the capsules are put into a tub of water, which water is then stirred vigorously, and the sediment containing the dye is then taken off and made into rough cakes. A large proportion of the colouring matter would seem, however, to remain in solution in the water which is thrown away. The cake extract, however, is scarcely used as a dye, but as an application in cutaneous diseases, and also for piles.

An experiment made by Pandit Sadanand, Extra Assistant Conservator of Forests, shewed that 40 lbs. of the fruit gave 6·6 oz. of extract, which is not bad, considering that it is only the powder on the outside of the capsules that is of any use. This is almost equivalent to saying that it takes 100 lbs. of the capsules to give 1lb. of the extract. A market for Kamela, of which the Dún can produce a large quantity, is much wanted.

The Gigantic Swallow-Wort.

The gigantic swallow-wort (*Calotropis gigantea*) is a shrub of two varieties, the only difference between them consisting in the colour of their flowers. It is commonly to be found in waste ground among rubbish, in ruins, and such like places. But the plant has gained much prominence from the many and important uses to which it may be applied. An acrid, milky juice flows from every part of the shrub when wounded, and this the natives use medicinally in different ways, besides prescribing preparations of the plant itself in epilepsy, paralysis, bites of poisonous animals, as a vermifuge, &c. In almost all cutaneous affections it is frequently employed, but its virtues have been largely tried in the cure of leprosy. The root, bark, and inspissated juice are used as powerful alteratives and purgatives. The activity of this drug is said to be owing to a principle called Mudarine, discovered by Dr. Duncan, of Edinburgh, who found the juice to possess the singular property of congealing by heat and becoming fluid again on exposure to cold. Mudarine is obtained from the tincture of Mudar, the powdered root being macerated and steeped in cold rectified spirit. After recovering the spirit by distillation, the solution is allowed to cool. A granular resin is then deposited, which is allowed to dry in order that it may concrete. If water be then applied the coloured solution from which the resin was deposited dissolves, and the resin remains. This solution is called Mudarine. In taste it is very bitter, soluble in alcohol and cold water, but insoluble in sulphuric ether or olive oil. By experiments made by Dr. G. Playfair the milky juice was found to be a very efficacious medicine in leprosy, dropsy, rheumatism, and in hectic and intermittent fevers. By the Hindoos it is employed in typhus fever and syphilitic complaints with such success as to have earned the title of vegetable mercury. Dr. Duncan held that it agreed in every respect with Ipecacuanha, and that from the facility of procuring it, it might eventually supersede the latter medicine. The pulverised root made into an ointment is a very efficacious remedy for old ulcers. The milky juice mixed with common salt is administered in cases of toothache, and the juice of the young buds in ear-ache. The leaves beaten up with pepper are given internally in cases of snake-bite, and boiled in oil they are rubbed over the body in scabies. Besides its medicinal uses, the plant and its products are utilized in various other ways. The root is used in the manufacture of gunpowder charcoal. In a powdered form it is used to adulterate safflower. The silky floss which surrounds the seeds has been woven into shawls and handkerchiefs, and even made into paper.

But the chief value of this plant consists in the fine, strong fibres in which it abounds. To procure them the straightest branches are cut and exposed to the air for at least twenty-four hours; on the second and third day they are slightly beaten; the skin is then peeled, and the stringy substance between the bark and the wood taken out. The fibre is then dried in the sun. This slow process is necessarily expensive, but if the bark is steeped in water, it discolours the fibre. This fibre is, however, strong, and possesses many of the properties of Europe flax. It can be spun into the finest thread for sewing or weaving cloth. It resists moisture for a long time. From experiments made its tenacity as compared with other Indian fibres is as follows:—

	Breaking weights. lbs.
Gigantic Swallow-wort (*Calotropis gigantea*) ...	552
Sunn (*Crotalaria juncea*)	407
American Aloes (*Agave americana*) ...	360
Cotton (*Gossypium herbaceum*)	346
Bowstring hemp (*Sanseviera zeylanica*) ...	316
Deccanee Hemp (*Hibiscus cannabinus*) ...	290
Coir (*Cocos nucifera*)	224

The fibre of the gigantic swallow-wort is thus very strong. But it is too valuable for ordinary cordage. It is said by good judges to be better suited for the manufacture of cloth than for cordage purposes. It is much used in India for bow-strings, ropes, bird-nets, and tiger-traps. The fibre has never, however, been cultivated as a cordage plant. It was once described as much resembling Belgian flax, well suited for prime warp yarns and worth £100 per ton. Royle says that it yields a kind of manna called Mudar-sugar. The viscid juice of the plant has been successfully converted into rubber in Madras. To prepare it, the juice is evaporated in a shallow dish, either in the sun or in the shade. When dry, it is worked up in hot water with a wooden kneader. It is soluble in oil of turpentine, takes impressions, and should prove a valuable product, either alone or mixed with other substances. It is strange that this handy plant with its various uses is not more widely cultivated in this country.

The Woods of Tasmania.

At a meeting of the foreign and colonial section of the Society of Arts, a paper was read by Mr. G. Colling Levey on "Tasmania and the forthcoming Hobart International Exhibition, 1894-95." The lecturer said that although so near Australia, and possessing, with a few additions, the same flora and fauna, the aspects of the two countries were entirely different. The length of

Tasmania was 210 miles, its greatest breadth 200 miles, and its area about 24,330 square miles. The interior combined the climate of Brittany or Cornwall, but without their humidity, the beauty of the Apennines, and the fertility of England. The leading productive industry of the colony was mining, but its mineral wealth was only partially developed. There were three great sources of wealth which up to the present time were undeveloped. There was no reason why the ornamental woods—the blackwood, the Huon and King William pines, and the myrtle, might not be largely employed in England for furniture, or why the hard woods, such as the red gum and the box, should not be employed for street paving.

In order to secure a thorough trial in England of Tasmanian hardwood for use as blocks for street paving, the Government of Tasmania offers to assist the timber merchants of the colony in forwarding a trial shipment of timber sufficient to cut about 10,000 blocks, and to be disposed of in England on the most favourable terms obtainable for laying down in the streets of London or some important provincial town. If five timber merchants in Hobart will each contribute 9 in. by 3 in. timber in planks equal to 2,000 5 in. blocks, delivered at the Hobart Wharf, the Government is prepared to pay freight on the same and all incidental charges in England. It is propose to consign the shipment to the Agent-General. It is anticipated, that if not a remunerative price, at least a large proportion of the shipment may be recovered by the sale of the timber, and any such return, the Government proposes, shall be divided *pro rata*, according to the expenses to the colony and to those who supply the blocks. Should it be expedient to give the consignment away to leading municipal authoritiee, so as to secure a trial and advertisement for Tasmanian timber, merchants will lose the cost of their several contributions, and the Government the amount paid for freight and other charges. (*Timber Trades Journal*).

The Brandis Prize.

The awards of the Brandis Prize for 1893 have been made as follows :—

To Babu Upendranath Kanjilal, for paper on the cultivation of the Date Palm.	**Rs. 50**
To E. M. Buchanan for article on the Andamans.	**,, 35**
To Mian Moti Singh for article on Deodar in Kulu.	**,, 35**

Forester and Lumberman in the Adirondacks, by Gifford Pinchot.

A tree in the virgin forest of the Adirondacks which has reached its full height has had an extremely interesting struggle for life. It exists as a survivor, having outgrown and overcome very many competitors, most of which have died and disappeared. After it has secured its place as an adult member of the forest, the tree bears seed from time to time, the seed germinates, and the generations of seedlings grow for a while in its shade, and then perish successively for want of light. Finally, the parent tree passes into old age, becomes unsound, and falls, and the young seedlings which happen to be under it at the moment, or which appear after a time about its roots, spring up under the influence of the light which the old tree no longer intercepts, and the struggle for supremacy is repeated by the younger generation until one or more of them takes its place among the grown trees of the forest.

So through the life and death of millions upon millions of individuals the life of the Adirondack forest has gone on for centuries unbroken. Nor is its continuance endangered even by the severest accidents, unless man interferes. If a windfall happens to make a break in the forest cover, or if fire destroys it over a certain area, a different process takes place; but nature provides, nevertheless, for the continued life of the forest. Where the openings is made in the forest cover the vegetation at first is composed of plants peculiarly suited to the new conditions, such as grasses and briers. The first trees which appear—generally poplars and fire cherry—come up because they are specially fitted to overcome the enemies and hardships which meet them in the "slash." Then, when they have prepared the right surroundings of soil and shade, the old kinds—spruce and maple and beech, or whatever they may have been—come gradually back, and after a time the forest is restored as it was before the interruption. Such a process is an exceedingly long one; for nature is as indifferent to the length of time over which her operations extend as she is to the life of the individual. It is only the life of forest itself which, in the long run, she effectually protects and sustains. But it is the regular cycle of growth which is of greatest interest to the forester, because from it he derives his own method of handling the forest.

If, then, we consider the life history of the forest untouched by windfall or fire, we find the same prodigality of time, and, from the standpoint of our needs, a very great loss of timber. In order to give the forest its true place as a permanent resource, we must adapt the natural process of the endless birth and death of the trees to the uses of man, to whom time is of the first importance and timber a very valuable commodity. This is the province of the forester. But in his attempt to preserve the forest by making it useful, the forester is necessarily met by many limitations, chief among which is always the nature of the return which the forest must be made to yield. The first and most important restriction in the Adirondacks is, consequently, that which is imposed by the merchantable value of the different trees.

Speaking roughly, at the present time only the softwoods in the New York wilderness have a merchantable value, and consequently they alone can be cut by either the forester or the lumberman. We must therefore leave out of consideration the hardwood trees as a forest product, and speak only of the others. We have seen that nature makes room for young trees by the decay and fall of the old tree which has long outlived its prime, and has for years been appropriating to small purpose the space and light, by the help of which a younger generation might have been developing into the raw material of valuable lumber. Nature's object—the continued life of the forest—is secured, but there is a serious loss of time and timber, from the human point of view. On the other hand, the forester takes each tree both when its useful qualities are in their prime and when there is young growth of valuable species under it to take its place. The cutting itself is done in such a way that the young trees, on which the future usefulness of the forest depends, are injured much less than under nature's method, because the direction in which the tree is thrown is not left to the wind or to some other chance, and because the top is not allowed to injure permanently the young trees upon which it may have fallen. The dense cover which gives the forest its value as far as the water supply is concerned, is preserved with the greatest care. It may be noted here that the removal of the trunks of the trees so that they do not rot on the ground has comparatively little to do with the value of the forest floor as a factor in the water supply. It is the twigs and leaves, and more especially the latter, whose annual fall and decomposition are of most value to the floor—far more, both chemically and mechanically, than the fall of the whole tree once in two or three centuries.

The fundamental difference between the policy of the lumberman and the forester in the Adirondacks, or elsewhere, is in the attitude of each towards the future. In both cases it is the natural result of previous training and experience, and as such each opinion is entitled to consideration. In is only when the practical effect of the two policies on the general welfare becomes manifest that we are justified in preferring the one to the other. The lumberman, with the present alone in mind, cuts and markets all he can profitably handle, with little reference to the effect of his action on the future supply of lumber. The forester, whose conception of the forest may be somewhat illogically described as that of an endless succession of second growths, works from a different starting-point. His object is to draw from the forest the largest return which it can be made to yield without endangering its general value to the public, and with the express condition that its productive capacity for the future shall not be diminished, but increased. While the lumberman cuts all that he can market, the forester cuts only those trees which, for the welfare of the forest itself as well as for the product to be had from them, ought to be removed, and does it in a way to do the rest of the forest, and especially the young growth, the least possible injury.

Divergent as these two methods may seem in the probable money result, there is one peculiarity of the Adirondacks which will enable the forester, even at first, to make but a slightly lower money return than the lumberman, and after a comparatively short interval, as time must be reckoned in the forest, to surpass him altogether. This is the fact that the merchantable softwood trees form only a small proportion of the forest (probably not over 5 per cent.), and are scattered by single trees or small groups through a vast body of unmerchantable hardwood timber. Lumberman and forester are, therefore, both compelled to go long distances for their timber, and to take only a tree here and there. At first the forester would cut somewhat fewer trees than the lumberman, and it would cost him a very small percentage more to get his logs from the stump to the mill, on account of the care he would use not to damage the future forest. But the money advantage which lies with the lumberman in this view of the case is small at the best, and as soon as even the nearer future comes into consideration it disappears altogether. After the first two or three cuts on the same ground the balance must begin to lean to the other side, simply because the forester is actively concerned in keeping up the proportion of the valuable species, while the lumberman, whose interest in the land he cuts over is generally a short one, has seldom any reason for considering its future value. For example, it is sufficiently obvious that if, in a stream which contains a few trout and a great many pickerel, the trout are systematically caught out at the time when they reach the spawning age, and the pickerel systematically left alone, there will soon be no more trout. In the same way the spruce in the Adirondacks, whose struggle for existence against the broad-leaf trees is even now a hard one, as its small proportion in the mixture testifies, will inevitably disappear if it is steadily cut with no regard for its renewal. The fact that in many instances several cuts of spruce timber have been taken from the same ground at intervals of from fifteen to thirty years is no answer to this statement, because a generation in the life of the spruce has not passed since the first cutting was done, and the crop for the second and third cutting was already on the ground at the time of the first one. I studied for several weeks the handling of a forest in Switzerland which was once composed almost entirely of coniferous trees, whose character was so changed by the long-continued demand for soft lumber that now the conifers form only about the same proportion that they do in the Adirondacks. And even this proportion is only maintained by constant planting—a method of renewing the spruce in the North Woods which would be wholly out of the question on account of the expense, even if it were not entirely unnecessary. What will be the result of a continued drain on the softwood trees in a forest which begins with only this small proportion of them, and where no care is exercised to maintain their number, is perfectly clear. And with the disappearance of the spruce the chance of a revenue from the State forest for a long time to come must also disappear.

Nor are the advantages of forest management by any means limited to the future. Its bearing on questions of vital present importance is at least equally strong. Take, for instance, the question of fire. In the virgin or lumbered forest of the North Woods fires are, in general, of serious danger only on land which has much more pine or spruce than is usual. The pulp industry, the hunter, the small farmer, and, more than any other, the charcoal-burner, are mainly responsible for fires in the wilderness. But, with this limitation in mind, it is still true that fires are less apt to occur under the régime of the forester than under that of the lumberman. However earnestly the latter may attempt to guard against them in certain cases, his efforts, from the very nature of his position, cannot be as farsighted and continuous as those of the forester, nor can he afford to overlook the expense, however slight, which such efforts involve. Nothing so quickly destroys the value of a forest to the water supply as fire ; and conversely, nothing protects the sources of the streams so well as dense forest. Forest management, one of whose prime objects is to keep the forest cover intact and the floor in good condition, is therefore a safeguard to the usefulness of the North Woods in their capacity as protectors and equalizers of the water supply. Whether or not this is their most important service to the public, there is certainly no other to which the public attention has been more often and more urgently called. In a word, as against the serious disadvantages I have named, the single point which may be advanced in favor of lumbering on land in the North Woods held or controlled by the State, when compared with forest management, is that of a somewhat larger immediate profit, although at the cost of much greater future returns. Whatever weight such consideration may rightly have with private owners, it is precisely that one which the State, as the perpetual owner of forest land, is bound by every consideration of justice and foresight to disregard.

Enough has been said to make it clear that in my conception the harm which lumbering does, from the standpoint of forest preservation, arises as a consequence of the way in which the lumberman regards the forest. It is the natural and reasonable result of his training, and no more to be decried as inordinate greed than the attitude of the ranchman toward his cattle, or the mine-owner toward his mine. The fault is not with the lumberman, but with the body politic, which fails to use the means of forest preservation which it has at hand. Nevertheless, we have seen that, for the best interest of the general good, to lumber the Adirondacks is not the best way to treat them. To restrict the lumbering to trees of a definite size is doubtless better than to lumber without restriction, but the objections which apply to ordinary lumbering apply here also, although perhaps not in the same degree. The twelve-inch limit fixed by the law of New York for certain cases is an instance in point. (It should be said that, in practice, this limit is really not restriction at all. It is not at all unusual for lumber companies who own their land to restrict cutting to trees twelve inches in diameter. The lumberman who simply buys stumpage on State land naturally confines himself to the larger trees, because, while he pays for all his logs at the same rate per thousand feet, board measure, the same amount of lumber is worth more to him in large logs than in small ones.) As regards the effect upon the forest of lumbering restricted to trees of twelve inches, or any other minimum diameter, it does not, in the first place, provide for proper precautions in favor of the young growth. In a forest of very different character in North Carolina I have found by practical experience that a difference of at least ninety-five per cent. was made in the condition of the dense young growth after cutting the old trees by taking certain precautions which did not increase the cost of felling and handling more than two or three per cent. This work, it may be noted, was done under my direction by a young Adirondack lumberman. In the second place, the twelve-inch rule allows the lumberman to cut many trees which, for the good of the forest, should be allowed to remain. A tree is not ready to be taken, from the forester's point of view, simply because it has reached a certain size, but because, having reached a merchantable size, the interest of the forest as well as the interest of the revenue, demands its removal, and because provision has been made to have its place taken by other trees of the same or of equally valuable species. The continued removal of the softwood trees, which form but a small proportion of the growth, without special precautions in their favor, would, as we have already seen, eventually lead to their practical extinction from the Adirondack forest, and with it too the disappearance of the largest source of revenue which the State can draw from them until the distant time when it will pay to handle the hardwoods.

But while these fundamental differences between the work of the forester and the lumberman exist and determine their whole relation to the forest so long as they act separately, it does not by any means follow that the preservation of the forests can be attained without the lumberman's assistance. Effective forest preservation can only come through the co-operation of the practical lumberman. The language of forest reform in his country has generally been of such a character as to lead to the inference that the forester and the lumberman have nothing in common, and that with the advent of the forester the lumberman must inevitably go. I conceive the facts in the case to point to a very different conclusion. The mechanical ingenuity of American lumbermen, acting through many years, has developed for each part of the country a system of handling timber which we are safe in assuming as perhaps the most efficient and economical that the given circumstances will allow. The forester, from the necessity of the case, has an understanding of the forest from another side. His knowledge of the best way to handle forest land for the production of timber through an indefinite series of years, ot the conditions which affect the reproduction of various trees, and of the position of the forest in the general economy, and his special training in other matters pertaining to the woods, all touch on points which the lumberman has not felt the need of knowing, and consequently has never learned. But as soon as the forester begins practical operations, unless he is also a practical lumberman (a combination which I never happened to meet or hear of), he is simply compelled to go to the lumberman for help. The division of labor which has developed itself in practice in my own work in North Carolina is as follow:—The preparation of the general plan devolved upon the forester, as well as the decision as to the location and amount of each year's cut. He was responsible for the selection of trees to fall, although a considerable part of the marking was done by the lumberman according to his instructions, and the general oversight of the whole operation fell upon him much as it does upon the general superintendent of a lumber company. The lumberman, on the other hand, who was born and bred and trained in the North Woods, had largely the same kind of work and responsibility that would have fallen to him had he remained in charge of a camp at home. He had to look out and build roads; see that the draught animals, tools, and the whole force in general, were in good working order; inspect the felling, and see that it was done in accordance with the instructions of the forester, and with as little damage to the young growth as possible; see that the logs were properly put up and scaled; inspect and control the saw mill, and, in brief, take direct charge of the practical operations.

The advantages of such an arrangement are obvious, but they are only to be realized when, as in the case just cited, the lumber-

man has received training enough in forestry to allow him to grasp and adopt the spirit of forest management. Once this is accomplished,—and, to judge from my own experience, the time required is not long, nor is it altogether a loss as regards the current work of the forest,—the efficiency of both lumberman and forester is greatly increased. The forester is relieved of a mass of detail which is peculiarly burdensome because outside of his special training, and so may devote himself fully to the larger questions which he alone can decide, secure in the knowledge that his instructions are being strictly and understandingly carried out. The practical skill of the lumberman, on the other hand, becomes available for the benefit of the forest in a way that was impossible before, while the business success of the work is almost entirely in his hands. The success of the technical details rests upon his intelligence and fidelity in a degree scarcely less marked. In a word, forest management in the United States is only a little less dependent for its success in practice upon the lumberman who carries out instructions than upon the forester who gives them.

In conclusion, then, it may be said that for many reasons the Adirondacks are peculiarly well suited to forest management. The soil is excellent, from the standpoint of tree growth, but of little value for any other purpose. The young growth of the valuable species of trees, with the single important exception of white pine, is always sufficiently, and often exceedingly, abundant. The small proportion of the valuable softwood trees makes it possible for forest management to yield, from the very start, almost as large a return in money as lumbering; and, as we have seen, the balance must change soon and permanently to the other side. The great interests which are involved in the maintenance of the water supply are fully protected under forest management, which is not the case under any form of lumbering, however restricted in the size of the trees which may be cut. The protection of fish and game falls naturally to the forester, whose training and traditions both fit him peculiarly for such work. In all countries where forestry has become established, the functions of forester and game warden are combined. Finally the general character and very uniform composition of the North Woods are admirably adapted to the operations of forest management. In other words, nature's process of handling the forest, which must guide the forester and dictate his methods, needs very little change to respond completely to all the different demands which, as a civilized community, we can make upon the Adirondacks. There is no forest of equal area in this country from the management of which more useful, more immediate, or more lasting and assured results can be obtained.—(*Publications of the Massachusetts Society for promoting Agriculture*)

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

5th July 1894.

EAST INDIA TEAK. The deliveries for the first half of this year amount to 6,051 loads, against 6,564 loads for the first half of 1893; and in June this year 740 loads against 1,257 loads in June 1893. The market has shown some tendency towards local improvement, stocks continuing moderate and floating cargoes still being disposed of well ahead.

ROSEWOOD.—Stocks are sufficient for the present limited demand.

SATINWOOD.—Finely figured logs would sell well, but plain wood is not wanted.

EBONY.—Really good logs, in small parcels, would command fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superficial	6d.	to	12d.
Rosewood	„ ton	£5.	to	£8
Ebony	„ ton	£6.	to	£8

MARKET RATES OF PRODUCTS.

(*Tropical Agriculturist, July 1894.*)

Cardamoms,	per lb.	2s.	to	2s.6d.
Croton seeds	per cwt.	20s.	to	27s.6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	15s.	to	30s.
Gum Kino	„	£15	to	£18
India Rubber, Assam	per lb.	1s.7d.	to	2s.2d.
„ Burma	„	1s.7d.	to	2s.
Myrabolams, Bombay	per cwt	8s.	to	10s.
„ „	„	4s.	to	4s.6d.
„ Godavari	„	6s. 3d.	to	7s.
Nux Vomica, good	„	6s.	to	10s.
Orchella, Ceylon	„	15s.	to	22s.
Redwood	per ton	£3.10s.	to	£4
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	to	£30

THE
INDIAN FORESTER,

Vol. XX.] September. [No. 9

A Note on Sandalwood

BY
S. H. KOORDERS,
CONSERVATOR OF FORESTS IN JAVA.

Sandalwood is the product of various species of the genera *Santalum*, L. and *Fusanus*, R. BR., which both belong to the family of the SANTALACEÆ. The most important of these two genera is *Santalum*, of which some 20 different kinds are known to be indigenous in Asia Australia and Polynesia. Towards the east, *S. insulare* is found in Tahiti and the Marquesas group, and is locally known as "*eai.*" The most southerly is *S. Cunninghamii*, found in New Zealand, and locally known as "*Mairi.*" In the Sandwich Islands, and generally in the north, *S. pyrularium* and *S. Freycinetianum*, Gaud, are most common, both called by the Aborigines "*lanala.*" Towards the west, and especially in India, *S. album* is most frequently met with. Dr. Seemann discovered in the Fiji Islands a very valuable sandalwood tree, called by him *S. Yasi*, but this tree is already nearly extinct in. consequence of unrestricted fellings. In New Caledonia, *S. Lomei* and *S. Austro-caledonicum* are found, but these, from the same reason, are now scarce, although lately plantations have been formed in French territory. The wood of *S. latifolium*, *Fusanus spicatus* and *F. acuminatus* is exported from S. W. Australia to England, as is also a so-called sandalwood from Queensland, the product of *Eremophila Mitchelli* of the family *Myoporineæ*. These woods possess only a weak scent and are chiefly used in carpentry and joinery ; the wood of *S. myrtifolium*, Roxb[*], from Java and Coromandel has also little value. From Zanzibar small blocks of sandalwood are exported, and also from Venezuela sandalwood is sent to Germany, but the botanical origin of these woods is unknown, the former probably comes from the French station of Nossi-bé.

---

[*] Included under *S. album* in the "Flora of Br. India."—HON. ED.

Before the middle of the 18th century, India was the only country which exported sandalwood, but since its discovery in the islands of the Pacific Ocean, the largest quantities have been procured from thence, so that many of the local chieftains enriched themselves by this commerce; for instance the chief of Hawaii in the Sandwich Islands is supposed to have derived an income of some £60,000 annually by the sale of sandalwood in the commencement of the present century. But the supply of sandalwood from the islands of the Pacific is now almost exhausted, and Australia hoped to occupy the market once entirely in the possession of Polynesia. In 1884, the export of the wood from Australia rose to 2,620 tons, the product chiefly of *Fusanus acuminatus*, but the prices ruled low, on an average only £8 a ton, whereas the price of the best sandal in China rises from £12 to £40 per ton.

In Europe and North America sandalwood is used for making objects of art and luxury, whilst sandal oil is employed in perfumery and for medicinal purposes. Its use in medicine has much increased during the last few years, and large quantities of wood are now required to furnish the oil which is employed successfully in those cases where the balsam of copaiba was formerly considered to be a specific. In the trade, three kinds are distinguished, East Indian, Macassar and West Indian. The first is a product of *S. album,* the second probably from a closely allied species, and the third from the pseudo-sandal of Venezuela, which has been before mentioned. This so-called sandalwood is exported chiefly from Puerto Caballo, where it is called "*bucita capitala,*" but the scent both of the wood and of the oil is very different from that of true sandal.

The ether or oil to which is due the scent of sandal is contained in the heartwood and in the largest roots of the tree, whilst the wood of young trees and the sapwood of older specimens is almost without odour. The oil is obtained by distillation from the heartwood and roots. From experiments carried out by the Indian Forest service, one kilo. of wood yields about 16 grm. of oil; and about 5,000 kilos. are annually exported from Bombay.

India is now, as it was formerly, the principal exporter of sandalwood, and the importance of *S. album* is very marked. *S. album* like all other kinds of sandal is found only in a dry hilly country, and when met with in low-lying, damp localities the wood is almost valueless. As a rule, the tree reaches a height of 7 to 8 metres, with a diameter of 25 to 30 c.m., and so soon as the tree has attained these dimensions it should be felled on account of the danger of the heartwood rotting. The principal regions where it flourishes are Mysore, Coimbatore, north and north-west Nilgiris, Salem and Arcot, where it grows up to an elevation of some 900 metres above sea level. In the Malay Archipelago, *S. album* is only found growing sporadically. In Mysore, sandalwood is a Government monopoly, and the trees may only be felled and sold by special officers, the annual yield being about 900 tons, valued at £30,000. In Madras, where there is no monopoly, the export amounts from 500 to 600 tons annually, the tree being protected and reproduced by rational treatment.

The sandalwood tree is generally felled when about 20 to 25 years old, for experience has shown that at that age the product in oil is the highest; the felling takes place in the winter and the bark is immediately removed, and the limbs cut into logs of about 60 c.m. long ; these are then buried in the earth for some months, when the sapwood is removed by the white ants, leaving the heartwood untouched*. This latter is then dug up and dried in special racks for some weeks, great care being taken to prevent splitting. The wood is finally sold at public auction by the officials of the Forest Department, and purchased by merchants from all parts of India. Before the auction sale, however, the wood is sorted into lots according to its colour, the darker the colour the more oil it contains. In trade, red, yellow and white sandal is distinguished, but all three are the product of *S. album*. It is considered that the wood is darkest and densest close to the root, and in consequence the trees are felled as close as possible to the ground. Light yellow pieces of wood and those with much sapwood have little value, the most sought after are specimens of a dark yellow colour, or better still those with reddish brown veins, and further, the wood must be free from flaws, hard, and of fine grain, with an aromatic, slightly bitter, but not unpleasant, taste.

Large pieces of sandalwood are mostly exported to China ; smaller to Arabia ; medium sized pieces are utilized in India. The yearly import of sandal into China amounts to about 6,000 tons, but only a small proportion of this comes from India. Bombay receives yearly some 700 tons from the Malabar Coast, and re-exports some 450 tons to other countries.

Dr. Hunter pointed out some years ago that sandalwood was especially suited for wood engraving, some blocks having given 20,000 impressions without being materially injured. For this purpose dark colored pieces of about 12 c.m. from trees grown on rocky soil are most suitable.

Finally, it may be noted that the wood of *S. album* is commonly called sandal, when it should be "*Santal.*" The Arabic name is "*Santal,*" whilst on the Malabar Coast the name "*Chandanacotta*" derived from the Sanscrit, is used. In China, sandal is "*Tan-heong*" or scented wood.—(*Translated by S. E.-W.*)

---

* Note :—This is not always done. In Nilgiris the sapwood is simply chipped off.—Hon. Ed.

'East Indian Walnut.'

The following extract gives the answer to a question we once put in this Journal as to the identity of the wood known in the Home market as 'East Indian Walnut.' There is still, however, one little piece of doubt in our mind, and that is whether the *Albizzia*, which gives the 'Koko' of the Andamans, is *A. Lebbek*, or some other species. The *Lebbek* or Siris of North India is not a tree which is in any way remarkable for its timber, or even for the beauty of the small amount of heartwood which it possesses, and it seems difficult to understand that the same tree grown in the Andamans gives a valuable, useful and handsome furniture wood. However, there are parallels:—*Odina Wodier*, an ugly softwooded tree in the North, gives in Bengal a pretty red durable wood—heartwood of course— with a much smaller proportion of sapwood; and *Albizzia Lebbek* may do the same.

The woods of all the *Albizzias* are very like each other, differing chiefly in weight and hardness, and if *A. Lebbek* can give a furniture wood, why should not *A. procera*, which is probably much more common, *A. odoratissima*, and the Central Indian *A Thompsoni* (we wish Sir D. Brandis would publish his new species, which is very common, and which we have met with even in the Siwaliks) do the same, and be equally available for the European trade. We recommend this suggestion to forest officers near the coast, who are in the way of sending home consignments, and we also recommend them to study the question of 'burrs,' and whether it may not be possible to produce them artificially.

"According to the *Calcutta Capital*, the Deputy Conservator 'of Forests, Andaman Islands, stated, in reply to an official circu'lar, that 'the possibility of creating a regular export trade in 'East Indian walnut (*Albizzia Lebbek*) from India appears to be 'well worthy of the consideration of the Forest Department, as well 'as of timber merchants in Europe and this country.' The wood 'seasons well, is easily worked and carved, developes a beautiful 'grain, and is susceptible of a fine polish. Owing to these and 'other good properties it produces pretty as well as substantial 'furniture, and the small consignments which have been occasion'ally sent from the Andamans to London have commanded, for this 'purpose, a ready sale. In India, it is much used in ornamental 'carpentry and cabinet-making; and owing to its hardness and 'fair durability, for sugar-cane crushers, oil-mills, well curbs, 'wheel work, &c. It is also highly suitable for house-build'ing, although people in the northern provinces have a supersti'tion that it is unlucky applied to this purpose. The 'East India 'walnut' (not to be confounded with the true walnut of India, '*Juglans regia*) is found wild or cultivated in most parts of the 'empire, Bengal, Bombay, Madras, and Burma. Specimens have 'been forwarded to the Imperial Institute from the Terai forests 'of the Darjeeling District, from Satara, Poona, and other parts of 'the Western Presidency; from South Arcot, Malabar, &c., in 'the South; from Thayetmyo in Upper, and Tenasserim in Lower, 'Burma. The growth of the tree, which is said to attain a height 'of from 40 to 60 feet, with a girth of 6 to 8, and at times even '10 to 12 feet, is exceedingly rapid. Seventeen-year-old stems 'have been found in Sukkur, Sindh, to girdle 5 to 6 feet. The 'former Burmese Government, it is said, thought so highly of the 'timber (known in their vernacular as "kuk-ko") that a higher 'tax was fixed on the felling of it than on that of any other tree. 'Burrs of the East India walnut, as in the case of other furniture 'wood, increase in value with the intricacy and rarity of the design 'and the size of the burr. These are, as a rule, sliced up into 'veneers, and cost, not uncommonly, 10 to 20 times that of the 'plain wood; indeed, as high as 100 times the value of the ordinary timber has been paid for extremely curious and unique 'specimens."—*The Globe.*

The Malabar Steam Sawmills.

Through the courtesy of Mr. H. Brown I was afforded an opportunity of inspecting these interesting works on the 26th July last. The Mills are situated on the banks of the Cullai river, about a mile and a half from Calicut, and close to the Railway bridge over the river. Connecting rails have been laid to the works themselves, so that timber can be shunted in and scantlings removed without difficulty.

Owing to the swampy nature of the soil, it was found necessary to raise the basement some 4 feet above the level of the ground, and on this basement two large open sheds, roofed with patent tiles, have been erected.

The plant consists of an ordinary band-saw—a patent self-feeding band-saw by Messrs. John A. White and Co., of Dover. New Hampshire, obtained by Mr. Brown during his recent visit to the Chicago World's Fair, and two circular saws—all driven by a very fine 36 horse power engine by Ransome and Sims. I was particularly struck by the performance of the American band-saw which ripped through the hardest woods at a most surprising rate.

I timed its work carefully, and found that it turned out a candy (66⅔ supl. feet.) Malaoar measurement, per minute of mango wood. The usual rate for sawing by manual labour in Malabar is 1 rupee per candy.

The whole factory was a model of neatness, and every labour-saving appliance, which the ingenuity of Mr. H. Brown could invent, was there to attest to his great ability.

Work was in full swing when I arrived, and busy gangs of Moplas and Thears were engaged in carrying away and storing the sawn scantlings in the large tiled sheds provided for the purpose. One large shed was almost completely filled with splendid sleepers of Irul (*Xylia dolabriformis*) for the Nilgiri Railway. In another, carpenters were busy finishing off wooden blocks for the Madras Electric Tramway. Enormous piles of planks, etc., lay ready for delivery to the Madras Gun Carriage factory, Mysore Gold Mines, etc., and on every side were evidences of a thriving industry. Mr. Brown appeared to have his hands full, and was working at his utmost speed to comply with the numerous orders with which he seemed to be overwhelmed. This is entirely due to the careful and business-like manner in which he conducts the works, and the universal satisfaction he has given by low prices and good material to his numerous customers. Would there were more like him, for it is to the energy and enterprise of such men that the Forest Department will be in the future indebted for some of its success.

R. M.

On Extending the Culture of Silver Fir in France.

From the Revue des Eaux et Forêts, by Mons. A. D'Arbois de Joubainville

Firewood is gradually being replaced by coal, and as the supply of the former exceeds the demand, its price is steadily diminishing, with the result that the revenue obtained from coppice areas in France has decreased to a serious extent. Proprietors are endeavouring therefore to raise in their forests less firewood and more timber of both leafy and resinous species; and it is the extension of the culture of these latter which seems most urgent, for resinous woods are by far the most abundantly imported for consumption in France, the total value of such woods imported during the period 1881 to 1890 being eighteen hundred million francs.

Scots pine, spruce, larch, Austrian and Corsican pine, pinaster, Weymouth pine and silver fir have already been introduced into the coppices of France, but have produced very little timber. Many of them have died or have been cut before reproducing, and the results on the whole are indifferent. The silver fir, however, which unfortunately had been but sparingly resorted to, has given encouraging results. Below are given some examples:—

The first to be mentioned is a silver fir plantation of about 200 acres obtained from sowings in a beech coppice of the "Bois de la Fresse" near Bains in the Vosges, at an altitude of 1,300 feet on soil derived from the decomposition of the variegated sandstone. This plantation is very productive, and regenerates itself naturally. M. Broillard in his *Traitment des Bois* quotes this as an example to be imitated, and recommends the sowing of silver fir in spring, or at any rate after the fall of the leaves, for buried in these, the germinating plant is unable to force its way through, and dies soon after germination.

M. Broillard adds that in 1861 a similar substitution of species was successfully made in a coppice with standards in the communal forest of Bains similar to the above, and we have seen a work of this kind equally successful not far from there, soil and altitude being practically the same.

In 1762 a forest guard planted a basketful of young silver fir plants in a coppice in Normandy, some leagues to the south of Evreux, at an elevation of 660 ft. In 1840, these plants were 65 feet high, and their girth at 4 feet from the ground varied from 4·8 feet to 8·8 feet, and the seed given by these trees had resulted in an excellent crop of young plants. The silver fir forests of Normandy on a fertile soil at low elevations similar to the above have a very rapid growth, and consequently the wood is soft, a defect which diminishes the value. But as they grow so much quicker than at higher elevations the larger quantity of wood produced compensates in a great measure for its inferior quality and the revenue is greatly superior to that of the coppices. Some 50 years ago, the introduction of conifers was commenced in the coppice areas of the forest of Epinal (Vosges), and of all the species sown the silver fir is the one which has succeeded best, and in fact the only one which seems to have definitely established itself.

Numerous other instances of a similar kind are quoted, where the introduction of silver fir into various coppices of the Vosges has been successful, whereas other conifers have been more or less a failure.

In the State Forest of Verzy (Marne) about forty years ago blanks were sown with Scots pine, Austrian and Corsican pine, pinaster, larch and silver fir. The first did well while young, but have been attacked by disease, and are now anything but promising, all the rest are in a moribund condition, except the silver fir which is growing vigorously, and promises to give good results. The soil on which it is growing is a sandy clay of the lower tertiary, and the elevation is between 900 and 1,000 feet.

In the State Forest of La Manise in a coppice with standards, a plot of about three roods was sown with spruce and silver fir about 54 years ago. These have now attained a height of about 65 feet, whereas the oaks reserved as standards in the coppice round about them are just about half as much. Many of the former have a girth of 5 feet. The silver fir have produced numerous seedlings, whereas the spruce, though they bear cones, have not given any seed. In the adjoining forest of Revin, too, the spruce introduced about the same time have not been a success, they either get blown down by the wind or die standing, the fungus, *Rhizomorpha subcorticalis*, having attacked and killed most or all of their roots. They are thus gradually disappearing without having reproduced themselves. Subsequently, on the advice of M. Nanquette, silver fir was tried in a blank in this same forest, and is doing very well there. The compartments, in which the above mentioned conifers were sown, are situated at an elevation of 1,300 feet on a deep moist sandy clay soil. In the State Forest of Harquies, not far from the above, on a similar soil, but at a somewhat lower elevation, silver fir and larch were introduced into an oak coppice about 30 years ago, the former are in this case also doing well, whereas the larch, which showed a magnificent growth at the commencement of the period, are now in a hopeless condition.

As far back as 1864 the introduction of silver fir was recommended by M.M. Lanier and Mélard of the Forest Department on the transition rocks of the Ardennes, wherever there was sufficient soil, and this would have embraced the greater part of this region, as it is only on the abrupt slopes formed by faults that the underlying rock is insufficiently covered with soil. Had this been done, there is little doubt that this area would produce vigorous silver fir forest in place of the miserable stunted oak coppice and blanks now to be found there.

In the coppice of the north-east of France, on the plateaux and northern slopes where the soil is deep, this substitution of species would certainly be a success. The cost of such operations would be comparatively small, and in time a very much larger revenue would be obtained from them, not to mention that if these operations were carried out on a large scale France would soon produce enough timber of this class for its consumption, and thus save the enormous sums of money she now pays to obtain it from other countries.

A. F. G.

Prize day at Coopers Hill, 1894.

The annual distribution of prizes at the Royal Indian Engineering College, was held on the 26th July last. The usual gathering of old Anglo-Indians were present, and Lord Reay, in the unavoidable absence of Mr. Fowler, Secretary of State for India, presided over the ceremony. The President, Sir Alexander Taylor, read his annual report on the work done in the past year, ending up, as is his custom, with an anecdote, setting forth the quality of gratitude, on the part of a native, for an act of kindness done to him by an Englishman. Four Fellows of Coopers Hill have been made this year, of whom one, Mr. B. O. Coventry, is a Forest student or "Gardener," if we use the nickname given to Forest students by their Engineering *confrères*.

The number of students in residence at the beginning of the session (September, 1893) was 106, of whom about 32 were forest students.

The Senior Forest students had been apprenticed in pairs for over 5 months in Germany during the summer of 1894, and after the completion of that period of practical training, had returned to the College to complete the more theoretical part of their training. The students were placed under Prussian officers selected by Sir D. Brandis, and these received the students with much kindness and attention, which was fully appreciated and profited by. The long interruption of their College course, which this procedure necessitated, has proved to be somewhat inconvenient, and in future the students may perhaps be sent to the continent for their practical training after the College course is completed, as is now done in the case of the Engineering students at the College. Sir Alexander then referred to the sad death of Mr. C. C. Abbey, which is already familiar to our readers, speaking of him as a very promising young forester, the second in his year who had had a bright and useful future before him, which was brought to a sad and sudden end by the fall of a tree, blown down as he passed under it, while returning from his work in the forest.

Lord Reay addressed the assembly after the annual report had been read by Sir Alexander Taylor, and advised the Forest students to endeavour to work with the natives of India with whom they were brought in contact, and said that by so doing they would make their work much easier, and would also find the ordinary native, even if he could neither read or write, would be able to give them a great deal of useful information about the nature and character of the forests, near which they lived. He went on to say that if forestry occupied, in England, the position that it ought to, it would not be necessary to send the students to Germany to learn the practical side of the science ; but at the same time expressed his gratitude to the German officials who were always glad to welcome pupils from the College and to receive them most hospitably.

The Scholarship of the Vice-President of the Council of India for the best man in Forestry in the work of the first two years, was awarded to W. Mayes.

The following is the list of prizes won by forest students :—

3rd Year.

B. O. Coventry, 1st Prize, Forestry.
H. A. Farringdon, 2nd prize, Forestry.
C. H. Tennant, Entomology.

2nd Year.

W. Mayes, 1st prize, Forest Management ; Entomology ; Botany.

C. M. McCrie, 2nd prize, Forest Management.

1st Year.

W. A. R. Doxat—Sylviculture.
R. S. Hole—Botany.

The following are the names in order of merit of the Forest students who passed out as Assistant Conservators of Forests, 2nd grade, and will reach India next November.

B. O. Coventry, H. E. Bartlett, H. A. Farrington, W. E. Copleston, C. H. Tennant, D. A. Thompson, A. St. V. Beechey, W. W. Batchelor, G. W. A. Grieve, M. Lawson.

C. G. R.

II.—CORRESPONDENCE.

Disease of Cocoanut Trees in Travancore.

SIR,

I shall feel thankful if any of your readers would, suggesting remedies, kindly explain, for the benefit of us Travancoreans, the following interesting yet disastrous phenomenon :—

Quite recently, in the central and northern districts of Travancore, we have lost several beautiful cocoanut trees from decay of the tender, unexpanded leaf shoot. At first, the lower end of the shoot grows discoloured, and, in a few days, general putrefaction of this and more or less of the cabbage ensues ; the shoot droops and, in some cases, falls to the ground ; the tree decays soon after, and we are left lookers-on and losers.

In trying to account for this remarkable disease, we are convinced that it cannot be the work of the Rhinoceros or Longicorn beetle ; for both these depredators bore into the shoot, cabbage or stem of the palm and, by early detection and careful tending, in the majority of cases, death can be stayed. But in the case in hand, the only sign to us of the presence of the disease is the drooping on the tree of the leaf-shoot when, obviously, all our efforts to remedy the evil are ineffectual because too late. The explanation most generally accepted by the natives is that "falling stars" (meteorites, they say) have been at work. Another reason advanced has it that decay is brought about by an exuberance of sap, and that it can be remedied by bleeding the tree. This would at least appear to be plausible, from the fact that in our very moist climate evaporation is too slow to keep pace with the incessant ascent of water in the stem, and that it is only the moist vigorous trees that are, as a rule, affected; but the remedy is desperate. By a third cause given, the malady is attributed to the attacks of fungi.

With all these explanations, however, the fact remains that we are losing many of our valuable trees without making any attempt, so far as I know, to, if possible, prevent it. The hot weather has been unusually severe with us this year, and the monsoon rains unprecedentedly scanty; but I am not at all certain whether these facts are of themselves sufficient to explain away the very unsatisfactory state of affairs now obtaining in our cocoanut gardens.

A. M. SAWYER.

The Strongest Timber.

SIR,

With reference to your query on the above subject on page 241 of the *Indian Forester* for June, 1894, I send you the following extract, which supplies the information:—"On the other 'hand this order (Laurineæ) embraces the Bornean iron wood '(*Eusideroxylon Zwageri*), probably the heaviest wood known, 'and one which alike defies Teredo and Termite."—(Mason on Burma, its People and Productions"—Page 289 Vol II.)

Toungoo,
11th *August*, 1894 } W. J. LANE-RYAN.

Denudation of Nilgiri Slopes.

DEAR SIR,

I enclose an extract from the "*Madras Times*" of the 6th instant. This extract, which formed part of the Proceedings of the Nilgiri Planter's Association held on the 4th, is encouraging, as it shows that some planters at least appreciate the benefits of Forest Reservation:—

"*Government Reserves*—Mr. A. G. Nicholson's Resolution was then put to the Meeting: That Government be asked to throw open the reserves for selection for coffee planting as they have done on the Shevaroys. It was pointed out by Mr. Brodie that though several applications for land had been made by Shevaroy planters, no orders had yet been received from Government. Mr. Hodgson then said that as the terms of the Resolution were too vague to be of any use, and that as he himself was of the opinion that too much land had already been opened for cultivation in certain districts of the Nilgiris—thus causing, in his opinion, the unsatisfactory change of the seasons in late years—he proposed that the matter be adjourned to the next meeting. Mr. Grey moved an amendment to the effect that the whole matter be dropped *sine die*, as in his opinion there was already too much coffee on the Nilgiris, and not enough labour or manure to provide for the present needs. After some laughter, this amendment was dropped and Mr. Hodgson's carried."

A great deal of damage has already been done by the denudation of steep slopes on the Nilgiris, *e.g.*, the Coonoor Ghaut, and what is now required is the strict conservation of the woodlands still unreserved.

R. M.

Flowering of Bamboo in Coimbatore.

DEAR SIR,

In accordance with instructions received from the Conservator of Forests, I have to report that nearly all the bamboos (*Dendrocalamus strictus*) in the Pollachi Range of this Division flowered and seeded this year. The Range comprises the outer slopes of the Anaimalai Hills, and the forests situated at the foot of these hills in the Pollachi Taluk. The flowering and seeding of bamboos did not extend to the Tunacadavu Range, which adjoins the Pollachi Range, and is situated on the Anaimalai Hills. I observe that the teak in both these Ranges is flowering profusely, and I think that a good seed year may be expected.

H. B. BRYANT.

Collection of Hirda Fruit in Satara.

SIR,

As promised some time ago I send you a total return of the dry Hirda as sold from our Depôts since 1888-89; if you add 20°/ₒ for dryage the original collection of green Hirda will be approximately obtained. The "kandy" mentioned, when dry measure is taken, weighs 1,920 lbs. as nearly as possible. 20 mds. or 240 pailis = 1 kandy.

		kdy.	mds.	pailis.
1888-89	... ...	317	13	4⅛
1889-90	... ...	148	7	5⅛
1890-91	... ...	234	8	0⅛
1891-92	... ...	260	11	8¾
1892-93	... ...	304	11	4¾
	Average 5 yrs. ...	253	2	4¾
1893-94	... ...	549	9	6¾

I notice that this year the climatic symptoms are very similar to those of last year, and that the absence of hail-storms has, in addition to what I formerly mentioned, been a very probable cause of the abnormal increase, or at any rate one of the concomitant factors.

R. S. FAGAN.

"Block in promotion."

SIR,

As you have inserted a letter from a Bombay Forest officer on the above subject, it is but fair to bring to notice the very great block in the Punjab, C. P. and Berar list which is much worse than in Bombay or anywhere else. Officers of 23 and 24 years' service are still 3rd grade Deputy Conservators, and the block is proportionately bad in the lower grade. So when a chance of promotion does occur, it is particularly galling not to be given it. Mr. R. Thompson, Conservator, who reached the age of 55 in December, 1893, obtained one year's extension, and now it is believed he is to be allowed to serve on for another year, and perhaps a third!!

During 34 years' service Mr. Thompson has never given his juniors a chance of acting promotion—having never taken furlough—not even privilege leave, except on one occasion: therefore nothing is due to him from Government on the score of half-pay!

Surely there cannot be any reasonable ground for granting this officer a second year's extension when it is remembered that Col. Doveton, who ought to be considered the father of the C. P. Forest Department and who *slaved* at his work all his service, failed to obtain even *one* year's extension though he tried hard to get it. Any way, he gave us some 6 years' acting steps by taking both long and short leave.

A. J. C.

30th July, 1894.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Budget Estimates of the Forest Department for 1894-95.

The Budget Estimates for 1893-94 were on page 380 of our last Volume. The following are the figures for 1894-95.—

Provinces.	1892-93.			1893-94.			1894-95.		
	Actuals.			Revised Estimates.			Finally sanctioned by Government of India.		
	Receipts.	Charges.	Surplus.	Receipts	Charges.	Surplus.	Receipts.	Charges.	Surplus.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
India.									
General Direction ..	..	77,432	—77,432	..	76,000	— 76.600	..	73.000	—73,000
Indore	5,237	1,375	3,862	4,000	2,000	2,000	4,000	2,000	2,000
Imperial Forest School ..	1,982	50,304	—48,322	2,000	66,000	— 64,000	3,000	65,000	—62,000
" " Survey ..	520	22.157	21,637	..	28,000	— 28.000	..	30,000	—30,000
Ajmere	14,887	14,997	110	14,000	15,000	— 1,000	15,000	15,000	.
Andamans	3,60,486	2,31,206	1,29,280	4,54,000	2,54,000	2,00,000	4.00,000	2.17,000	1,83,000
Baluchistan	19,037	55,623	— 36,586	23,000	28 000	— 45,000	30,000	67.000	—37,000
Coorg	1,80,676	73,075	1,07,601	1,52,000	87,000	65,000	1,47,000	58,000	59,000
Total India ..	5,82,825	5,26,169	56,656	6,49,000	5,96,000	53,000	5,99,000	5,57,000	42,000
Central Provinces	12,30,855	8,50,940	3,79.915	12,10,000	9,40,000	2,70,000	14,00,000	10,50,000	3,50,000
Upper Burma	20,76,629	4,40,929	16,35,700	23 00,000	5,00,000	18,00,000	20,25,000	6,25,000	14,00,000
Lower Burma	35,83,372	13,61,288	22,21,484	34,00,000	13,95,000	20,05,000	32,00 000	13,85,000	18,15,000
Assam	3,82,829	2,63,904	1,18,925	4,54,000	2,74,000	1,80,000	4,20,000	2,96,000	1,24,000
Bengal	7,44,882	3,81,292	3,63,590	7,82,000	4,11,000	3,71,000	8,00,000	4,60.000	3,40,000
North-Western Provinces and Oudh.	16,52,539	9,22.397	7,30,142	16,76,000	9,80,000	6,96,000	17,16,000	9,67,000	7,49,000
Punjab	8,12,632	6,55,118	1,57,514	8,50,000	6,50,000	2,00,000	9,00,000	7,00,000	2,00,000
Madras	15,77,212	13,22,888	2,54,324	19,00,600	13,44,000	5,56,000	18,00,000	15,45,000	2,55,000
Bombay	32,69,544	18,98,269	13,71,275	35,50,000	21,00,000	14,50,000	36,00,000	22,47,000	13,53,000
Total ..	1,53,30,494	80,97,625	72,32,869	1,61,22,000	85,94,000	75,28,000	1,58,61,000	92,75,000	65,85,000
England	..	17,770	—17,770	..	12,000	— 12,000	..	7,000	— 7,000
Exchange on charges in England	..	10,690	—10,690	..	8,000	— 8,000	..	5,000	— 5,000
GRAND TOTAL* ..	1,59,13,319	86,52,254	72,61,065	1,67,71,000	92,10,000	75,61,000	1,64,60,000	98,44,000	66,16,000
Berar ..	4,31,017	2,29,230	2,01,787	4,90,000	2,52,000	2,38,000	5,00,000	2,50,000	2,50,000

Statistics of Trade in Forest Poduce in 1892-93.

Total weights and values of articles carried by Rail and River in British India during the year 1892-93, *i.e.*, between 1st April, 1892, and 31st March, 1893.

ARTICLES AND WHENCE EXPORTED.	IMPORTED INTO.				VALUE.			
	British Provinces, excluding chief Seaport Towns.	Native States	Chief Seaport Towns.	Grand Total.	British Provinces, excluding chief Seaport Towns.	Native States.	Chief Seaport Towns.	Grand Total.
	Mds.	Mds.	Mds.	Mds.	Rs.	Rs.	Rs.	Rs.
MYRABOLAMS								
British Provinces (excluding chief Seaport Towns)	16,356	15,071	5,80,846	6,12,273	50,286	56,516	15,91,778	16,99,120
Native States	51,320	..	41,048	92,368	1,58,054	..	1,48,010	3,06,064
Chief Seaport Towns	10,935	4,455	26	15,416	43,546	16,066	84	59.696
Grand Total	78,611	19,526	6,21,920	7,20,057	2,52,426	72,582	17,39,872	20,64,880
CUTCH								
British Provinces (excluding chief Seaport Towns)	17,610	4,081	10,289	31,980	2,74,478	60,906	1,57,365	4,92,749
Native States	2,584	..	656	3,240	41,579	..	9,061	50,640
Chief Seaport Towns	13,688	1,126	..	14,814	2,29,180	16,967	..	2,46,147
Grand Total	33,882	5,207	10,945	50,034	5,45,237	77,873	1,66,426	7,89,536
HORNS								
British Provinces (excluding chief Seaport Towns)	9,786	133	47,612	57,531	63,292	1,354	7,29,569	7,94.215
Native States	2,419	..	9,949	12,368	35,778	..	1,52,989	1,88,767
Chief Seaport Towns	4,067	62	25	4,154	73,346	1,008	410	74,764
Grand Total	16,272	195	57,586	74,053	1,72,416	2,362	8,82,968	10,57,746
LAC (1) STICK.								
British Provinces (excluding chief Seaport Towns)	1,34,830	2,466	47,512	1,84,808	23,38,126	45,064	7,20,543	31,03,733
Native States	7,810	..	31	7,341	1,19,014	..	622	1,19,636
Chief Seaport Towns	9,709	85	2	9,796	2,06,178	1,691	47	2,07,916
Grand Total	1,51,849	2,551	47,545	2,01,945	26,63,318	46,755	7,21,212	34,31,285
LAC (2). SHELL.								
British Privinces (excluding chief Seaport Towns)	1,820	549	1,25,896	1,28,265	64,523	18,486	46,55,988	47,38,978
Native States	380	..	22	402	11,761	..	697	12,458
Chief Seaport Towns	699	51	..	750	26,619	1,795	..	28,414
Grand Total	2,899	600	1,25,918	1,29,417	1,02,903	20,281	46,56,685	47,79,869
Total Lac.	1,54,748	3,151	1,73,463	3,31,362	27,66,221	67,036	53,77,897	82,11,164

Forest Policy in Bombay.

The following unofficial Note, by the Inspector-General of Forests, on some questions of forest policy now under consideration in the Bombay Presidency, will be read with great interest by most of our subscribers. It gives the personal views of Mr. B. Ribbentrop, C. I. E, on the subject, and we hope its views will commend themselves to the Government, and end in securing a better Forest system for the Presidency than it has hitherto enjoyed.

The first question on which I beg to record my opinion is that connected with the division of lands at the disposal of Government into forests proper, fuel and fodder reserves, and pastures.

It is evident to me from a study of the Bombay Government's Resolution No. 6840, dated 5th October, 1891, that the Government of India's Circular No. 17—105 of 15th July, 1891, has, in some particulars, been misunderstood. So far as I am aware, the Supreme Government did not contemplate, when issuing that Circular, that the existing forest reserves should necessarily be sub-divided into forests, fodder and fuel reserves, and pastures; and though it was doubtless recognised that certain portions of these reserves might be treated with the primary object of producing fodder or even as pasture-lands, it was by no means considered essential that their connection with the Forest Administration should be severed.

It seems clear that the Circular had in view an analysis of each district as regards the supply of fodder and the demands made on that supply, and that in this analysis the supplies available from forest reserves should find their due place. For, even under the most conservative forest treatment, there must always be considerable areas which yield fodder and perhaps pasture; and a rational management of fodder-reserves, and even of pasture-lands, does not entirely exclude a certain amount of tree-growth.

This view apparently coincides with that expressed by the Honourable Mr Trevor in his minute of 16th January, 1893, and has since been supported by the Government of India in paragraph 8 of letter No. 217-F., dated 20th February last.

The remarks which follow refer, in the first instance, to the Deccan, which from its circumstances has been persistently cited as peculiarly unsuited to a conservative forest management necessitating any interference with the customs and habits of the people. Owing to the short time at my disposal while on tour, I could not undertake anything but a very superficial examination of the Deccan forests; but I purposely selected for inspection and enquiry areas within easy reach of the railway lines, which were said to be the least adapted for conservative management. I am therefore disposed to believe that my views refer with equal force to other areas similarly situated, and still more so to forests of which the conditions are less unfavourable.

I am fully convinced that the whole of the Deccan was once forest clad. My reasons for this opinion are the existence of solitary trees, even in the most exposed localities, and the improvement which has taken place in the forest-growth where hillsides have been closed against grazing, as in the driest parts of the Poona and Sholapur districts, for example. The soil in localities so protected for some years is entirely different in its physical characteristics from that in the areas open to grazing. The grass-crop has not merely improved in quantity but most decidedly so in quality and denseness, and tree-growth has established itself to a considerable degree, even in places where no artificial means have been used to assist nature in this respect. The tree-growth is as yet represented only by bushes, which is but natural, as in many instances the very soil had been washed away previous to the introduction of conservative management and closure which, to judge from the browsed state of much of the brushwood, has hardly ever been entirely successful. In spite, however, of these disadvantages, I have no doubt that many of the bushes will grow into trees, and that the wood-crop of the next generation will show a great improvement in growth as well as in variety of species.

It cannot, I think, be gainsaid that, from a strictly climatic, physical and economic point of view, it would be of incalculable advantage if a considerable portion of the Deccan uplands, including at least all tracts of which the slope is 15 degrees and upwards, were again brought under tree-forest, instead of being occupied, as is the case at present, by fields, open pastures or scrub jungle.

A reforestation of the kind would not be physically impossible, but as it would necessitate a much stricter closing of the present grazing-areas, and closing for such a length of time, it would be incompatible with the existing economic and political conditions of the country, and this alone would prevent its ever being carried into effect.

While, however, I fully recognise the impossibility of ever restoring the economically correct balance of forest and open lands in the Deccan, I cannot but consider it the duty of Government to treat those areas which are still at its disposal as conservatively as circumstances will permit.

If no other considerations came into play than the ultimate good of the country, it would be advisable to close for an indefinite time, not merely to grazing but to grass-cutting as well, all reserves situated on hilly ground; but the fact has to be faced that the lands in question must now, and probably for ever, yield a considerable portion of the fodder-supply of the country, especially as there is no prospect whatever of grazing-areas beyond the limits of State reserves being subjected to an intelligent and conservative treatment.

It must also be recognized that areas primarily treated for the growth of trees yield less fodder than forests treated for the production of fodder or pasture, in which the growth of trees or bushes is a secondary consideration. I maintain, however, and venture to challenge proof to the contrary, that the system which more than any other, results in the continuous diminution and degradation in the character of the fodder-supply, is the system at present in vogue outside our forest limits, and to a considerable extent within them, *viz.*, the non-restriction of grazing as regards number of cattle admitted, and even more so as regards the season of admission. This seems to be the strongest objection to the argument (which occupies so prominent a place in Sir Charles Pritchard's minute) that free-grazing should be allowed in order to maintain the supply of cattle.

Whilst I thus agree, as regards the Deccan, in the necessity of separating the State forests into fuel and fodder reserves and pastures, according to the management which it is proposed to apply to each category, I maintain that each class must be treated so as to yield the maximum of natural produce in quantity and quality combined, be the produce timber, fuel or fodder.

That this can only be effected under an intelligent and reasonable treatment is an accepted axiom in more civilised countries and has been happily illustrated of late by the successful management of the military grass farms in the north of India.

It is evident that a rational treatment of the kind cannot be carried into effect without serious restrictions, and amongst them a limitation of grazing, both with regard to the number of cattle admitted and the season during which grazing takes place. There can be no doubt that in this country such restrictions necessitate a considerable interference with the customs and habits of the people.

The difficulties in this respect are connected, in my opinion, not so much with the original reservations, which frequently were (see Sir Charles Pritchard's minute) easily made when the forests taken up in no wise differed from the surrounding country, but rather lie in the fact that, as soon as some years of protection have produced magnificent grass crops, which stand out like oases amidst the barren grazing-grounds, a popular clamour arises, and with it the difficulties of the administration.

The change in the conditions is not, I venture to think, due to the transfer of the management of the forests from the Revenue to the Forest Department, but to the gradual development of a more rational management under which the grazing area is doubtless curtailed, but by means of which the fodder supply available, even from the restricted areas, has certainly been increased. I question whether, under such conditions, it would be advisable or even equitable to the people to remove any of the restrictions necessary to produce the maximum quantity of grass. I believe that it would be in every respect advantageous if the control rested as heretofore with the Forest Department.

The restrictions required to ensure a rational management have no connection with the consideration of free-grazing privileges from the monetary aspect. This is a question of financial and not of forest policy, and the Forest Department is only indirectly interested in it. Experience, however, teaches that the privilege of free-grazing has usually had a demoralizing instead of an encouraging effect on agriculture, and has frequently led to the up-keep of many useless cattle. The advisability of encouraging, in a more or less settled agricultural country, semi-nomadic professional graziers seems also open to question. As a rule, such graziers disappear with the advance of agriculture.

I have above acknowledged the advisability of a departmental separation of the areas under the control of the Department in accordance with the purpose which they should serve in the first instance. In my opinion, each reserve should be studied separately, and the decision should, in each case, be based on the following considerations :—

(*a*) physical (including climatic) ;
(*b*) economic and agricultural ;
(*c*) financial ;
(*d*) political.

The first (*a*) need be taken account of only when the area in question is of considerable extent, or occupies slopes the denudation of which would endanger lands lying below, or affect works of public utility, such as roads, railways or tanks. In such cases these considerations may be of great importance, and an area selected for these reasons should be thoroughly protected, as little or no physical effect can be expected to be derived from an open scrub jungle. The area would therefore naturally be classed as forest.

I have seen during my short tour several forests which I would unreservedly place for the above reasons in the category of forest proper, though I would recommend in such cases a treatment varying in strictness. A gradual and periodical closing would be advisable of the areas more favourably situated for the production of tree-growth. I would close others entirely, not merely to grazing, but against grass-cutting as well, and for an indefinite period. As an example of a case where a radical course of the kind would be desirable, I may cite the forest block south of the Phursangi railway station, on the Southern Mahratta railway and to the west of the line, but there are, I daresay, many other blocks of equal importance. The reserve in question occupies a steep slope which overhangs the railway for a considerable distance, and the drainage of which flows into the Nira valley. A more unpromising area could hardly be found, but for this very reason its strictest protection is the more necessary. To insure the success of fire protection, a trace should be burned above the railway line; and in order to make closure against grazing more effectual, the most exposed boundaries should, I think, be fenced with barbed wire. I am of opinion that it would be of advantage if every Deccan forest division were furnished with 5 to 10 miles of barbed wire-fencing, to assist in the protection of areas closed entirely or periodically against cattle trespass, the prevention of which throws at present a great strain and much undeserved *odium* on the Forest Department.

Considerations mentioned under (*b*) would, in most instances, show whether an area should be classed as a fuel and fodder reserve or as pasture land. Thus, small scattered blocks of less than half a square mile in extent, for instance, cannot possibly be of any special value as pasture-grounds, but may be of great importance as fodder-reserves, especially if favourably situated. The economic value of timber and fuel in a district particularly in want of these commodities may also often decide whether an area is to be primarily maintained for the supply of such produce. For instance, an affirmative decision of the kind seems decidedly advisable as regards the valuable babul reserves on the Bhema and other rivers.

The reason given under (*c*) may frequently decide the question as regards areas where other conditions are more or less equally balanced, as in the case of small babul forests which though of no importance for climatic reason, may bring in a considerable revenue per acre. Considerations of the same kind might show that some of the very small isolated reserves should be entirely abandoned, in cases where expenditure on protection and treatment is equal to or exceeds the revenue, and where none of the other reasons demand the maintenance of such small forests.

Political reasons (*d*) may in some cases outweigh all others in favour of some particular treatment and classification; but, in my opinion, undue weight should not be given to the existence of old habits and customs, which frequently change rapidly under the pressure of circumstances.

If an area has been classed as forest proper, the aim should be to establish a complete leaf-canopy as soon as possible. In extreme cases all grazing should be excluded, and the whole or at-least a considerable portion of the forest should be closed even to grass-cutting. Under any circumstances, grazing and grass-cutting should be so regulated that at least one-fourth to one-third of the area should be closed for a period of years, which should certainly not be less than ten.

As a rough sketch for a plan of working the Deccan hill reserves, such as those which I have seen during my recent tour, I venture to submit the following proposals for consideration: that one-third of each block be closed both to grazing and grass-cutting; that this closed area be divided into ten compartments; that at the end of ten years one compartment should be thrown open (but not during the rains) to grazing or grass-cutting, as the case may be: and that closed compartments of about the same area be added from the unclosed block, and so on. Thus forty years will have elapsed from the first closure until the compartment first opened is closed again, and by that time it will probably be possible to accompany the second closure by a slight improvement-felling

When an area has been classed as a fuel and fodder reserve, it should be closed against regular grazing, though even under a good system of management it may be thrown open to grazing from time to time, especially in years of scarcity after the grass crop has been reaped. To throw it open annually to cattle would tend to exhaust it; for when fodder is reaped the grass is never very closely cut, and a considerable portion of what is left serves as manure for the next year's crop. Moreover, the cattle, if admitted annually, would attack the edible bushes, and the aim that the area should furnish a reserve of fodder in years of scarcity would be defeated.

Grass-cutting in fuel and fodder reserves should be carried on with caution and under strict rules, so as to ensure the safety of ligneous growth. In this connection, I may mention that during my visit to the Brambuede reserved forests, I observed that the Commissariat contractor had used a mowing machine, the course of which was marked by stumps of young trees and plants, and that in other places, also unsuited to the use of the machine, the tree-growth had been treated in a ruthless manner. This is highly objectionable; and though it may be advisable to place forest resources at the disposal of the Military Department, without showing the true financial aspect of the question, such a careless and destructive gathering of produce should not, I venture to think, be permitted.

As regards the treatment of pastures, I have already recorded my opinion that the aim should be to grow annually as much and as good fodder as possible, and in order to effect this it is indispensable that both the number of cattle admitted and the season of grazing should be limited. This may not be the popular course to take, but it is common sense; and the system by which the largest amount of fodder can be produced should, as a rule, be adopted in spite of popular opposition. The question is one which increases in importance in proportion as the country is dependent on these sources of supply.

If it be granted that such restrictions, even as regards areas classed as pasture, are necessary, an establishment must be maintained which is fit and able to enforce them; and since the District Forest Officer is directly subordinate to the Collector, I venture to doubt whether the latter officer has a better, more efficient, or cheaper agency than the Forest Department at his disposal.

In this connection the fact should not be lost sight of that, under any circumstances, a considerable portion of the existing reserves must be classed as forests proper; the areas must be territorially intermixed; and that the treatment to be applied to all, though varying in detail, is similar in its general character.

I am convinced that a separation of the charges would certainly result in an increased expenditure. I cannot close this paragraph without pointing out that, though it has been laid down that the system for the treatment of pasture-lands shall be such as to exclude, as far as possible, interference on the part of subordinate officers, this refers to the closure and opening of grazing areas, and not to the necessary protection of areas authoritatively closed and the impounding of trespassing cattle, especially where trespass takes place systematically.

I am personally opposed to the award of a double punishment under the same law. Trespassing cattle are first impounded and the evidence of the pound certificate is used to bring an action for trespass, or in order to compound the case. It has, however, been pointed out to me that the opinion of the Magistrates and the rulings in force are in favour of this procedure. I should have thought it more advisable to increase authoritatively the pound fees, or to withdraw the privilege of grazing agricultural cattle at reduced rates from any habitually offending village, or even to increase for such a village the general grazing fees.

As regards the executive and subordinate forest establishments, I have already pointed out that I consider the withdrawal of a portion of the Deccan establishment impracticable and inadvisable. No doubt forest establishments find a proper place in real forests, but they are even more required in those parts of the country where it is considered advisable to establish forests. As far as I am able to judge, the ranger class especially is insufficiently represented in the Bombay forest staff, and good rangers cannot be obtained in a day. Lastly, I cannot possibly agree with the view expressed that ranges should be formed in accordance with the magnitude of the timber revenue.

Apart from the questions regarding the position of Conservators towards the Government, and the rules referring to the relation of Revenue and Forest Officers, which, if my opinion thereon is desired, will be treated of in a separate note, I have only two more points to remark upon.

The first refers to the advisability of having the whole of the coupes, into which the forests are divided for purposes of working, and which as yet exist only on the maps, laid down and demarcated on the ground. Till this is done and the maps have been corrected accordingly, the plans, though doubtless they have done much to systematize work, must bear the stigma of being paper plans only. There is no guarantee that the coupe of one year will yield a tenth or even a twentieth of that of the previous year, though it can unquestionably be urged that, with a large number of working-circles, variations in the outturn will equalize themselves Nevertheless, the demarcation on the ground should, if practicable, be effected as soon as possible ; for in the meanwhile a permanent working-plans officer will be required for no other purpose than to transfer the position of the annual coupes from the maps to the ground.

In conclusion, I venture to suggest the establishment of one or more teak forests below the ghats, to be treated for the growth of large timber. For this purpose areas of not less than 5,000 acres in extent should be selected and set apart from the existing forests. They should be carefully fire-protected, and closed against grazing and grass-cutting of every description, and should from the outset be treated with the view of establishing high timber forests of teak. If the areas are carefully selected as regards soil, position and parent trees, I doubt whether it will be necessary to have recourse to artificial cultivation on a large scale, though it will of course be advisable to assist natural reproduction by clearing away brushwood, lightly breaking up the soil, and by dibbling in seed in prepared patches, or even to certain extent by planting.

It may also be advisable to procure every year, from Burma or Canara, teak seed from full-grown and healthy seed-bearers ; but on the whole I think we may trust to natural reproduction, for it is a historical fact that some of the Malabar forests at one time contained the finest teak in the world.

CAMP, B. RIBBENTROP,

11th March, 1893. *Inspector-General of Forests.*

IV.—REVIEWS.

A Bombay Forest Flora.

Under the modest title of a "Systematic List of the trees, shrubs and woody climbers of the Bombay Presidency" has just appeared what practically is a Forest Flora of Bombay. In the small compass of 230 octavo pages, the author, Mr. W. A. Talbot, Deputy Conservator of Forests, has published a work which fills a most important gap in our knowledge of the forest vegetation of India. It is by no means only a *List* that Mr. Talbot has prepared. It is what, to our mind, is wanted in all Provinces, a concise account of the trees and shrubs with the simplest possible means of identifying them, brought up to date with the assistance of the "Flora of British India," by Sir J. D. Hooker, now approaching completion; and its preparation is a credit to its author, and through him to the Forest Department in India, which has sometimes been twitted with its apathy as regards botanical knowledge of the vegetation it has to deal with. As a model Forest Flora, no work, not even that of Willkomm for Germany, can, in our opinion, touch the "Flore Forestière" of our late honoured Nancy Professor, Mr. Auguste Mathieu; but very near it indeed will come the 'Forest Flora of North-West and Central India,' by Sir D. Brandis, which still holds its own as the guide of all the forest officers whose lot it is to serve in the Punjab, the North-Western Provinces and the Central Provinces with the adjoining Native States. For Lower Burma we have the admirable, if lightly too technical, flora of the late Mr. Sulpiz Kurz; and for the Madras Presidency there is the "Flora Sylvatica" of Col. R. H. Beddome, which is unfortunately too much spoilt by its unwieldy size and by the inclusion of Ceylon plants, which make it very difficult to consult. Hitherto, Bombay officers have had to be content with Dalziel and Gibson's "Bombay Flora," but that work, excellent as it was for the time it appeared, is now out of date, and we are sure that they will all welcome this new work, and make it the standard authority of their Presidency. The only great area now remaining to be done is that of North-East India in Bengal and Assam, but that will be by no means an easy task.

Mr. Talbot has done quite rightly in reducing his work to a manageable size, those who want further botanical details can always go to the Flora of British India, but for ordinary purposes Mr. Talbot's work should amply suffice.

The Bombay Presidency, says the author in his Preface, contains, as principal regions, (1) Sind, (2) the Deccan with Khandesh and, we presume, Guzerat, (3) the Konkan and (4) North Kanara. The first and second are dry regions, the others moist ones, the last being "a very important great region of three thousand square miles of more or less continuous jungle," which probably furnishes the larger part of the species described.

The book gives, first of all, a key to the natural orders, then the descriptions of the plants under their orders. Each order is briefly described, then follows an analysis of the genera, then the descriptions of the genera, then an analysis of the species themselves, with the references to previous authors, the native names and the geographical description. Here and there, as especially under *Rubiaceæ*, some new species are described. The only fault we can find is that the analyses are difficult to follow. Instead of printing the selected points in gradually indented lines, they are all given in one vertical line, and it is by no means easy always to trace the alternative characters. Should a new edition be called for we hope that this may be rectified. Here and there we notice small printer's errors, such as are inseparable from work done in this country, and the binding might be better, but on the whole the work is creditable to the Bombay Government Press. We cordially congratulate Mr. Talbot on his work, and feel sure that all those whose duties take them into the Bombay forests, will thank him for his excellent manual of their vegetation.

Annual Forest Administration Reports for 1892-93 for Assam, the North-West Provinces & Oudh and the Forest Surveys.

The ASSAM report shows that a great deal of steady work was done during the year in almost all the branches of Conservancy and Works. The financial results were very favourable, the figures for the first year of 15 months on this occasion having been:—

Receipts	4,76,620
Expenditure	3,36,060
Surplus	1,40,560

Naturally enough, the Chapter on reproduction is the one of most interest to us and our readers. In it we find the question of the gradual spread of Sal forest over the areas of grass land known as Savannahs discussed, and it is satisfactory to note that Mr. Campbell, the Goalpara Divisional officer, considers that Sál is gradually replacing secondary growth of an inferior description. On the flowering of this during the year he says:—

"In the year under report, flowering was not only partial but almost non-existent, and no fruit resulted from the few flowering specimens. This was the result of intense cold and rain at the period of most active vital growth, not admitting of assimilation. The tendency of extension is easterly, as seeding usually occurs during the prevalence of violent south-westerly breezes. Khoir (*Acacia Catechu*) and Sisu (*Dalbergia Sissoo*), favouring shallow soil, are also spreading rapidly, the former possessing the great advantage of persisting during floods. With its weak ramification and want of tap-roots, however, it succumbs to storms. It exists in greater or less quantities throughout the district, and is extending. Of Sisu there is much pure forest, as well as that mixed with Khoir. Both are disseminated by water and establish themselves and spread by ordinary methods, suckers being a huge factor in Sisu. There is a great future in store for this forest.

"Other valuable marketable timbers also exist and are extending, such as the various Myrabolams (*Terminalia Chebula* and *Belerica*) and Simul (*Bombax malabaricum*). The latter, like the Sal, was conspicuous by absence of inflorescence during this season, except in the western corner of the district."

The Conservator also mentions that in Sibsagar District, the natural reproduction of Nahor (*Mesur ferrea*), Ajhar (*Lagerströmia Reginæ*) and Sam (*Artocarpus Chaplasha*) was very good; while that of Holong (*Dipterocarpus pilosus*) and Hollock (*Terminalia myriocarpa*) was a failure.

The question of whether old over-mature Sal trees can be relied upon to produce good seed, was tested, as described in the following extract, in the Garo Hills :—

"With a view to ascertain whether the over-mature Sâl trees in the Dambu reserve do still retain the power of reproduction or not, the Divisional Officer, under the suggestion of the Conservator, selected a dozen over-mature trees in that forest, from which seeds were collected carefully and sown separately on prepared beds, one seed bed being appropriated to seeds from each tree. Manure in the shape of wood ash was freely supplied to these beds at the time of their preparation. The trees from which the seeds were collected were numbered and labelled, and a corresponding number was put on each seed bed. The seeds were sown in June, 1892, and after a few days they germinated freely. It was thought, however, that the seedlings would not survive; but, contrary to expectation, they are still living and growing with vigour.

"The germinating power of Sâl seed is so extraordinary that, even under Kakua bamboos (*D. Hamiltonii*) in many places, seedlings are noticed to grow. The absence of Sâl seedlings in the younger forests is due to the density of the crop. In the plains forests, such as Chima, Bangshi, Dhima, Dilma, &c., the reproduction of Sâl is more satisfactory."

The well-known plantations of India-rubber at Charduar were the subject of much correspondence during the year, with the result, we understand, that the Government of India have stopped further expenditure for a time. The plantations now cover 2,063 acres, and contain 28,546 good trees.

We are glad to see that both the Local Government and the Government of India speak in high terms of Mr. McKee's administration and of his excellent report.

The chief noticeable point about the volume referring to the NORTH-WESTERN PROVINCES AND OUDH is the rather effusive Review by the Government of India, who say:—

"The conservancy and management of the valuable forests
'of the North-Western Provinces and Oudh have, it is evident
'from the reports under review, been characterized by energy and
'ability, and the local administration may fairly claim to have
'secured a leading place among the provincial Forest Depart-
'ments."

They give especial credit to Mr. Wilmot, the Oudh Conservator, and remark that the progress made in late years has been—
"largely attributable to the interest displayed by the Local
'Government in the settlement of forest questions, but also in
'some part to the equipment of the province with capable forest
'officers, whose aim it has been to place the permanent constitu-
'tion and current management of the forests on a safe basis, and
'to secure an effective demand for forest-produce proportionate
'to the general development of the country. Mr. Wilmot's excel-
'lent work in Oudh affords an illustration of the valuable results
'which can in a few years be obtained by intelligent organiza-
'tion in this direction."

Of the three Circle Reports we have found that of the Central Circle the most interesting as regards matters suitable for notice on our part. There are some interesting statistics given in an Appendix, obtained from the results of measurements of Sâl trees taken in sample plots. The Conservator, Mr. Hill, considers that the average increase in girth is better arrived at by calculating from the original measurements made in the first year of observation and those of the last, than by taking the average of ascertained annual increments, but gives the results obtained in either way. We give the results taken from the sample areas which have been longest established, that is, for 9 years:—

	KUMAUN DIVISION.				GARHWAL DIVISION.	
	Lachman Mundi.		Sunman Thapla.		Amtanola.	
	Thinned	Unthinned.	Thinned.	Unthinned.	Thinned.	Unthinned.
(1)	·80	·35	·65	·34	·79	·38
(2)	·77	·30	·63	·37	·65	·33

where (1) is the average annual increase in girth per tree, from yearly increase; and (2) is the average annual increase in girth per tree, from 1st and last years.

Mr. Hill concludes from the measurements that 3rd class trees of 3 ft. in girth will attain 4½ ft. in from 26 to 37 years, and that 4th class trees of 1½ ft. will become 3rd class in from 16 to 23 years under favourable conditions.

In remarking on natural reproduction, there are some interesting points noted about that of oak and 'chir' pine, which we quote:—

"Regarding the hill forests the Deputy Conservator of the 'Naini Tal Division reports as follows :—

"It has been a good seed year for oak. The Conservator 'considers that the young growth of chír in many parts (especially 'of the Ránikhet Sub-Division) upon which we were priding our'selves, is really stunted and unpromising, and the bulk of it has 'scarcely made way for many years, though possibly some has 'with difficulty now escaped from the damage done to it in early 'times. Oak, Rhododendron, Ayar (*Pieris*) and Kaiphal (*Myrica* '*sapida*) are spreading well in among the chír, where they will 'eventually doubtless fill up the spaces which are practically al'ways to be found in chír forest, and at the same time will, in 'addition to thus increasing the amount of material per acre, 'render the ground cooler and make fire conservancy much 'easier."

"The open and most incomplete condition of many of these 'forests can scarcely be held to bear out the satisfactory remarks 'on natural reproduction which have appeared in the progress re'ports of past years, and the opinion is hazarded that the officers 'reporting have fully understood the absence of that power in the 'young *Pinus longifolia*, which failing is common to all light'loving species, to recover and gain vigorous health after under'going years of suppression or injury. This want of appreciation 'of the sylvicultural requirements of the chír has in places led to 'heavy fellings over an advance growth which has but little 'promise, and where it might have been better to have rooted up 'the existing young growth and waited for the establishment of a new 'crop. The broad leaved species are spreading without doubt, but it 'seems evident that the regeneration and complete stocking of the 'closed areas would be very much expedited by the removal of the 'stunted young chír, and by the dibbling in of acorns on a large 'scale. The oaks seed with regularity, and the cost of dibbling in 'is little more than a rupee an acre. *Pinus longifolia* seeds more 'rarely, and advantage might be taken of good seed years to pre'pare the soil in patches in blank places. With so much aid given to natural reproduction, these forests might be gradually converted from the open grass-growing lands, which too many of the compartments now are, into dense mixed forests of chír and oak."

The remarks of the Oudh Conservator show that there has been much confusion in settlement work in former years, for he says :—

"Much labour and research was expended during the year in overhauling the notifications regarding the constitution of the State Forests. There were instances of areas proposed for reservation, but never finally reserved ; of areas exchanged, but not disforested ; of areas belonging to State Forests, but neither claimed nor reserved. A series of reprints of all necessary notifications from 1865 up to date was issued from the Head Office to each Division, and it is hoped that now order is in some measure restored, there will be little difficulty in maintaining it." And we believe that similar rectifications are going on in the other Circles as well.

In regard to artificial reproduction, Mr. Wilmot has some rather strong remarks which deserve to be read. We agree with him that spending money on planting works without very careful consideration of the suitableness of the locality, of the kinds to be planted, and the object of the work is much to be deprecated ; but at the same time we believe strongly that the improvement of the natural forests, if well done, requires considerable assistance from artificial work, and in suitable places the establishment of well stocked plantations is a very important means of increasing and improving the forest area. We need only point to Changa-Manga as an example of the latter kind, and to the successful filling of blanks in the Jaunsar and other deodar forest, in the North-West and Punjab Himalaya as an example of the former. Such works are very valuable, but the planting of Sissu in water-logged lands such as those of Gorakhpur or those of Pathri in Saharanpur is a waste of money and energy, as is the endeavour to make species of Eucalyptus grow in places where they cannot give products at all as good as what are furnished by the indigenous timber trees. Mr. Wilmot says :—

"No cultural operations were carried out in the circle during the year ; existing plantations were kept up, but available funds are more profitably employed in opening up natural forests than in futile gardening in unsuitable localities. The principal plantations of the circle are situated in Gorakhpur, the largest area being 2,206 acres under Shisham at Sakwi. The Divisional Officer anticipates that here, as elsewhere, where grown on a water-logged soil, the Shisham may die off, before reaching maturity, so soon as the main roots reach water level. The other petty plantations are interesting, but the time spent on them 'would have been more profitably employed in protecting and 'improving the important forests of the circle, for where natural 'reproduction of valuable species is forthcoming, the artificial 'rearing of exotics should be regarded only as a pastime."

The financial results for the forest year, July 1st, 1892, to June 30th, 1893, for which the Reports are submitted were :—

Receipts,	17,46,269	The *net* revenue being 45 per cent. of the *gross*.
Expenditure,	9,53,411	
Surplus	7,92,858	

The Report of the Superintendent of the Forest Surveys shows the usual progress in field Survey, tempered by the inability of the Imperial Survey to keep pace with it in the publication of its maps. The area surveyed during the year was 1,804 square miles, of which 851 square miles were demarcated State Forests. Most of this area was mapped on the 4-inch scale. Work was in progress chiefly in Bashahr, in the Punjab, in Pilibhit and Kheri in Oudh in Raipur, Narsingpur, Bhandara and Mundla in the Central Provinces ; in Goalpara in Assam ; in the Tenasserim Circle of Lower Burma and in the Pyinmana District of Upper Burma.

The cost of the work naturally varied in different Districts, but we extract the following rates per square mile :—

	4-inch Scale	1 inch Scale
Bashahr	Rs. 59	Rs. 10-5
Raipur	„ 48·5	
Bhandara	„ 53·9	
Mandla	„ 50·6	
Narsingpur	„ 57·9	
Oudh	„ 18·0	
Goalpara	„ 89·9	
Tenasserim	„ 81·7	
Pyinmana	„ 36·3	

The total expenditure of the Department was Rs. 1,25,513.

The exceptionally heavy cost of the Assam work is explained by the difficulty of the country worked in, which is well shown by the following extract from Mr. E. Litchfield's Report :—

" The survey of the Goalpara forests has been a most difficult 'and troublesome undertaking. The absence of labour and supplies 'on the spot, the want of roads, the difficulty of transport, the dark 'densely-growing forests with thickly matted undergrowth, the 'impenetrable grass 15 to 25 feet high, the opaque haze during 'dry months, the excessive rain beginning at the end of March 'when the whole country is flooded, the unhealthy malarial nature 'of the country, and the distance of the trigonometrical stations on 'the Brahmaputra on which the Forest survey is based from the 'Forest Survey stations on the Bhutan hills without any intervening 'hills or high ground suitable for connecting stations,—all combined to add to the difficulty of surveying a naturally difficult, 'uninhabited and trackless area. On the Bhutan boundary the 'average rate of progress on the march was less than a mile an 'hour. Rice, ghee, dal, etc., were purchased at Dhubri, carried 50 'miles to Kochugaon, and stored there for distribution. Each camp 'was obliged to provide itself with a week's supply at a time, and 'in my own case I was obliged to carry, in addition, a supply of 'grain for the elephants. This did not leave much room for the 'very limited quantity of baggage and stores I carried for myself. 'But mutton, vegetables, milk and flour are not to be had; and 'all ordinary stores must be imported from Calcutta."

Both the Surveyor General and the Government of India comment in high terms of praise on the work done during the year by the Superintendent, Mr. W. H. Reynolds.

Report on Forest Administration in the Jeypore State for 1893.

In the number for November last year, we reviewed the Jeypore Report for 1892 and gave many extracts. The present Report is fairly interesting also, but we regret not to be able to trace the whole of the extracts said to be made from our Review of last year.

The Superintendent gives an interesting account of the history of the Madhopore forests, which appear to have been protected since a very early date for the sake of the Fort of Ranthumbar, which is situated inside them. In these forests, it is noted, that if bamboo shoots do not get plentiful rain within a fortnight of their starting, they are apt to die off.

The financial results of the year were :—

Revenue	25,342
Expenditure	8,405
Surplus	16,937

which is a little better than last year.

Report on the Botanical and Afforestation Department, Hongkong, for 1893.

As in previous years, a great deal of planting work has been done, the number of trees planted having been 279,648 or 232 acres. As usual, the chief tree planted was *Pinus sinensis*. The planted area ought now to be very extensive, but the Report gives no indication of the total.

During the year much damage was done by the caterpillars of a moth, *Eutricha punctata*, and considerable difficulty was found in destroying them, especially as they are of a kind with stinging hairs like the well known 'Kambli' caterpillar, which feeds on babul trees in South India. No less than 30,219 trees were destroyed by this pest.

Fire-protection was as difficult as usual, and the damage done by fire was even greater than in 1892. This year, the fires are attributed more to grass-cutters, to people who remove dead pine leaves and collect cones, and to smokers, than to Chinese worshippers at their ancestors' shrines.

Report on Canal Plantations, N.-W. P., 1892-93.

Last year, in our December No., we remarked on the very unsatisfactory sort of report which is produced for these important works, and we are sorry to see that the one before us shows no improvement on its predecessor. With the exception of a slight reference to the Eucalyptus trees on the Upper Ganges canal, there is not a word about the species planted, or of the sylviculture of the plantations. And yet there must be interesting matters connected with them, which we Forest Officers would like to hear about. Though no mention of the fact is made in these arid reports, we believe that it is customary for the Conservator of Forests of the Central Circle in the North-Western Provinces to inspect them, or some of them, every year, and we would suggest that it would be interesting to add his Report as an Appendix in future.

The area of the plantations is given as 36,407 acres, which is 645 acres less than last year, but the decrease of a whole square mile of planted area is nowhere explained. We wonder what would be said if a Conservator of Forests reduced his planted area to such an extent without giving the reasons in his Annual Report!

The *net* revenue was Rs. 1,14,364, which is a little over Rs. 3 per acre. It is not stated, nor can we elicit from the very confusing statistical tables, how much, if any, of this is on account of establishment. Properly speaking a share of the pay of the Engineers who look after them should be debited to the work.

As regards the Eucalyptus about Kankhal it is now recommended that planting be stopped until it is ascertained that the wood is a really suitable one and cheaper than what is supplied from the forests, for the cribworks at the Hurdwar Anicut. We shall be very interested to hear the result, more especially as we have no belief in any of the *Eucalypti* being likely to do as substitutes for our excellent indigenous timbers.

Report on Arboriculture N.-W. P. & Oudh for 1892-93.

For the first time a separate Report on this subject has been published, and we have read it with interest.

From the return given in Appendix A we extract the following:—

	1st Class.	2nd Class.	3rd Class.	4th Class.	Total
Length of roads ...	4,674	7,016	10,073	4,790	26,553
,, of avenues ...	3,539	2,680	1,345	235	7,799
Balance without avenues	1,135	4,336	8 ,728	4,555	18,754

During the year 1892-93 185 miles were planted.

It is stated that in most districts the arboricultural works are managed by the Tahsildars.

The question of the best kind of 'tree-guard' is naturally discussed, the result being the recommendation of guards made of iron wire-netting which the Superintendent of the Saharunpore Botanic Gardens believes can be made at a cost of Rs. 1-2 each, 'provided he is allowed to purchase the netting from a particular 'firm in England.'

The Director of Agriculture recommends the greater use of the *Mahowa* (*Bassia latifolia*) as an avenue tree, also that the Babúl should be encouraged. No doubt Babúl will be useful for certain soils and in certain localities, but its drawback is that its crown is so low, and in South India, where it is common, it is infested with a moth whose small hairy caterpillar lets itself down by threads from the tree, and if it gets on to the skin causes a most painful itching. Perhaps this moth does not come up into Northern India, but we have seen the caterpillar and felt it, that is, one which we believe to be the same.

In respect to the objections held by native agriculturists to road-avenues, the Director says:—"In Allahabad, it is stated 'that private persons are showing increasing interest in the work; 'while from Jaunpur, on the other hand, the Chairman reports 'that the agricultural population have a rooted aversion to roadside 'avenues, on account of the damage done by shade to their fields, 'and that applications by private persons to plant roads are often 'meant merely to forestall genuine tree-planting by the Board. 'The applicants get permission and plant trees that are not intended to thrive. It is hardly possible that so unsatisfactory a state 'of things should have arisen without some reason for it in the 'method of tree-planting adopted in this district. On wide roads 'no serious damage to the fields need be apprehended if the trees 'are properly placed. On narrow roads some care should be taken 'in the selection of trees. Trees like the *Babul* can do no harm 'in such places, and operations should be carried on so as to gain 'the co-operation, not to arouse the opposition, of the rural population." And on this the Government remark:—"It is very desirable that the people should be taught to understand the value 'of plantations of trees, and much might be done in this way 'through the medium of District Board members. Where objections are raised, some reason for them will probably be found, 'and when this is ascertained the objections could either be explained away, or met by a judicious selection of the kind of tree 'planted."

The financial results are not so bad as might be expected. The expenditure of the year was Rs. 72,229, while the revenue came to Rs. 41,937, partly from 'lopping and felling' and partly from 'fruits, grass, etc.' To judge by our own observations of lopping and pruning work done, some professional teaching is much wanted, but perhaps it is supposed in this, as in other forest cases, that anybody can do such work.

VI.—EXTRACTS, NOTES & QUERIES.

The use of Sawdust in the Propagation of Plants by Cuttings.

The *Revue Agricole* of Mauritius contains an extract on a practical and interesting method of propagation by cuttings which should prove useful to horticulturalists. The writer states that though not generally accepted, the method described is one for which he has for many years abandoned all others, and from which he has derived the greatest satisfaction.

Silver fir sawdust is recommended as being the best for the purpose, but not being able easily to obtain it, the writer made use of the sawdust of poplar wood, which answered very well. This was first sifted to extract impurities and spread on the frame of the propagating beds in a compact well pressed layer about 3 to 4 inches thick. This is then well watered several times, stirring it about to ensure its complete saturation, in which operation the greater part of its acidity also disappears. The next day it is ready to receive herbaceous cuttings of all kinds. An average temperature of about 58 degrees Fahr. should be kept up, and this amount of heat and a daily watering with about a gallon of water per square yard is all that is required to ensure the success of the cuttings.

Each square yard will take about 850 cuttings, which as soon as they have rooted, are pricked out into pots. In pricking them out, the sawdust adhering to the roots is gently shaken off, and the longest roots are pinched, or cut off with a pruning knife.

The same sawdust, provided it has not become too black, can be used again, occasionally it may be desirable to add a little fresh sawdust to the old layer.

The writer maintains that with such a system he has had the greatest success with cuttings of all sorts, the only exception being those of Pelargonium. One of the great advantages of the system is the economy of space, as the possibility of raising such a large number of cuttings in so comparatively small an area, renders numerous glass frames unnecessary.

A. F. G.

Monsoon and Trees

Mr. John Eliot's monsoon forecast is anything but encouraging, and it seems that in all probability, again, large tracts of the country will receive deficient rainfall. Meteorological conditions are matters of comparatively such exactitude in tropical climates that it seems a foregone conclusion that rainfall should be subject to fluctuations in fairly defined cyclical periods. Even the sun by periodic disfigurement of its face—so called "sunspots"—exhibits an undefined but evident concern in results. But when the country receives its normal quantum of rain, it remains a question as to whether it does so to the best effect. It is not sufficient that the rain rushes over the face of the country removing soil to be deposited in the making of delta land, or be carried fairly out to sea, or alter the course of rivers, or expose the bare rocks of the substratum ranges ; it is essential that it shall go to swell the flow of subterranean sources. In various parts of the country, we have been met with the statement that water in wells formerly having a high water level, never now attains the height secured, say, 30 years ago. This cannot be the result of better opening up of subsoil drainage outlets ; the tendency in the country has been, from opening of irrigation works and making of railway embankments, rather the opposite. To what then may this condition be ascribed ? In our opinion one of the chief factors is the deforesting of the country which has occurred. The rapid flow off the soil is the natural sequel of its permeability being no longer aided by the roots of trees. The influence which forest growth has in this direction has been long recognized, and the most common illustration of the fact is the condition of a road after rainfall, where on one side there are trees, and on the other these are absent ; the longer continuance of moist soil on the side with the trees is readily remarked. Nor is it in this detail only that the existence of tree growth exhibits itself in modifying meteorological conditions. As the result of evaporation and heat radiation, the air above forests is usually cooler than in the open country, and there are in respect to certain trees of the turpentine tribe volatile matters, which are supposed to possess valuable antiseptic and medicinal properties. The increase of cost of firewood is also a matter that to the labourer is also a point of no little importance, and from the standpoint of political economy is of interest. The presence of shade, protection from dust, and effect on foul and damp soil afforded by trees near villages, are points of hygienic importance. It is true the Forest Department is now trying its best to overcome the difficulties into which past neglect has plunged the country; but there are certain areas that are so absolutely stripped of the slightest pretence to woodland, that it is almost hopeless under a very great lapse of time and unremitting effort, to hope for even partial recovery. Some effort beyond that of the Forest Department is requisite. In many parts of India it is considered a virtuous act by natives to plant fruit trees. Why should this not be taken advantage of? In America, they have felt the pressing necessity of staying the destruction of forests, attempting to replace trees which were in days gone by ruthlessly destroyed. To this end, there has been held for many years past a feast day, the so-called Arbor day, when schools, public bodies, and private individuals plant trees. To make this idea "catch" in this country it would be necessary to associate the Arbor day with some note of progress. In our opinion, one of most remarkable events for good or evil in connection with the administration of the country has been the enlargement of Legislative Councils, and the recognition of the right of the interpellations. If natives are in earnest in their appreciation of these symptoms of advance and liberty, it ought not to be difficult to secure the co-operation of District Boards and Municipalities in appointing annually a great "Arbor day" for each Presidency. As years rolled on, if in each of our towns and villages this movement were taken up, there would result, at no expense to Government, belts of trees near towns and villages of considerable economic and hygienic importance. (*Indian Engineering*, *August*, 1894.)

Myrica Nagi, Thun.

BY DAVID HOOPER.

Quinologist to the Government of Madras.

Among the large number of astringent drugs indigenous to the East Indies, the bark of the Boxmyrtle (*Myrica Nagi*) has been long known. This tree belongs to a small natural order placed between the Urticaceæ and the Casuarineæ, and grows in India, the

Malay Islands, China and Japan. The bark is collected in the subtropical Himalayas at altitudes of from 3,000 to 6,000 feet, and is occasionally exported in large quantities to the plains. It is used as a tan for fancy leather work, and in some districts it is employed for dyeing a peculiar pink ; but as it is kept in stock by the native drug shops in Northern India this would indicate its chief use as a medicine.

In Sanskrit works the bark is described as heating, stimulant, and useful in diseases supposed to be caused by deranged phlegm, such as catrrhal fever, cough and affection of the throat. But like most Eastern remedies the bark is mostly prescribed in the form of a mixture with other stimulants, alteratives and aromatics. Dr. U. C. Dutt speaks of the powdered bark being simply used as a snuff for catarrh with headache. *Kaiphal*, the Hindustani name of the drug, mixed with ginger, according to some doctors, is the best medicine for cholera. Hindus and Mohammedans use *Kaiphal* at the present day as an astringent carminative and tonic, and prescribe it for chronic cough, fever and piles. Mixed with vinegar it strengthens the gums and cures toothache. It will be seen that it is used where astringents are required, either as an external or internal remedy, but the large dose of 60 grains of the powdered bark is not the best method of administration.

About five years ago, Dr. Dymock sent me for analysis a sample of Myrica Kino. This substance occurred in a granular condition ; it was of a dark purplish-red color, hard and brittle when dry, and without any peculiar odor. It dissolved almost completely in boiling water, but a flocculent red precipitate separated when the decoction cooled. A tincture made with rectified spirit was of a fine, bright red color and very acid in reaction. The tannic acid gave a greenish color with ferric chloride, and was estimated in a cold watery infusion of the drug with a solution of plumbic acetate. The "Kino" had the following composition :—

Pure tannic acid	60·8
Insoluble in water	3·3
Moisture	9·8
Ash	10·8
Sugar, etc., ...	15·3
Total . .	100·0

The large amount of carbonated ash left, on incineration, points to the probability of some of the tannic acid existing in combination with a mineral base, and this was really so. A large quantity of a substance readily reducing Fehling's test, is not a usual constituent of a natural astringent secretion like Kino, and I was relieved to find that the above substance had been prepared by evaporating a watery extract of the bark ; this would account for the mineral matter and the glucose.

The bark of *Myrica Nagi*, when collected from large trees, is about half an inch thick extremely scabrous, pitted from the separation of pieces of suber, of a mottled rusty brown and dirty-white color, suber warty ; substance of bark and inner surface of a dull red color ; it yields a red color to water ; taste strongly astringent. Examined microscopically, within the suberous layer is seen a remarkable stratum of stony cells : the parenchyma throughout is loaded with red coloring matter, and permeated with large laticiferous vessels, from which a gummy latex exudes when the bark is soaked in water.

Mr. J. Ishikawa (*Chemical News*, December 3rd 1880, p. 275) contributes a paper on materials containing tannin found in Japan, and from a substance named "Shibuki" bark (*Myrica rubra*) he obtained from 11 to 14 per cent. of tannin. If we may conclude that this tree is the *M. rubra*, Sieb. et Zucc., then it is synonymous with *M. Nagi*, Thunberg, the very tree under discussion.

A sample of *Kaiphal* bark from Bombay contained 11 per cent. of moisture and yielded 7·17 per cent. of ash. Estimated in the manner above mentioned, for tannin, it afforded 13·7 per cent. The lead compound of the organic acid contained 30·72 per cent. of oxide, a result which compares very closely with the amount found in the compound separated from the "Kino," namely, 31·88 and 30·36 per cent. in two estimations. The tannic acid, separated from the tincture by evaporation and treatment with water, gives a bluish-purple color with ferric chloride, but on adding this reagent to a decoction of the bark, a dirty green precipitate is formed.

Beyond determining the amount of tannic acid in an authentic specimen of this bark, and obtaining indications of an alkaloidal principle, I have not had opportunity for further examining the drug. It may on closer research be found to contain interesting crystalline principles, such as those recently separated from its neighbouring plants, species of the *Ficus* and *Casuarina* (*American Journal of Pharmacy, May, 1894.)*

Accident to Col. Bailey.

We regret to hear that Col. Bailey, R. E., so long Superintendent of Forest Surveys and Director of the Forest School, was one of the passengers injured in the Railway accident on the Highland Railway on August 3rd. The *Scotsman* says that he was standing up at the time of the collision, and sustained a rather severe injury to his neck and shoulders. His two sons, who were with him, were also bruised and shaken. He had to be left at Newtonmore, but was gradually improving, though he would be unable to go to Oxford for the meeting of the British Association, at which he was to be joint Secretary in the Geographical Section.

VII.—TIMBER & PRODUCE TRADE

Statement of average selling rates of timber and bamboos in Meerut, Cawnpore, Bulandshahr, Bareilly, Pilibhit and Moradabad for the quarter ending 30th June, 1894.

Description.	Timber Scantlings per score.		Bamboos per 100 scores.		Remarks.
	From	To	From	To	
MEERUT.	R. A. P.	R. A. P.	R. A. P.	R. A. P.	
Sal 10' Tors (Poles) ...	10 0 0	20 0 0	...	...	
Sal & Sain, &c., Kuries, 12' × 5" × 4" ...	25 0 0	38 0 0	...	...	
Sal bed posts, 7' × 2½" × 2½" ...	12 8 0	15 0 0	...	...	
Bamboos of 9' to 10' per 100 scores ...	...	...	40 0 0	100 0 0	
CAWNPORE.					
Sal 10' Tors (Poles) ...	4 8 0	5 4 0	...	...	
Sal, & Sain, &c., Kuries, 12' × 5" × 4" ...	20 0 0	60 0 0	...	...	
Sal bed posts 7' × 2½" × 2½" ...	10 0 0	12 8 0	...	...	
Bamboos of 9' to 10' per 100 score ...	...	...	30 0 0	60 0 0	
BULANDSHAHR.					
Sal 10' Tors (Poles) ...	...	...	...	...	
Sal and Sain, &c., Kuries, 12' × 5" × 4" ...	...	...	...	...	
Sal bed posts, 7' × 2½" × 2½" ...	...	...	...	..	
Bamboos of 9' to 10' per 100 score ...	...	...	35 0 0	56 0 0	
PILIBHIT.					
Sal 10' Tors (Poles) ...	40 0 0	70 0 0	.	...	
Sal & Sain, Kuries 12' × 5' × 4"	20 0 0	40 0 0	..	...	
Sal bed posts 7' × 2½" × 2½" ...	5 0 0	6 4 0	...	..	
Bamboos of 9' to 10' per 100 score ...	...	...	60 0 0	100 0 0	
BAREILLY.					
Sal 10' Tors (Poles) ...	5 0 0	10 0 0	...	...	
Sal & Sain, &c., Kuries, 12' × 5" × 4"	25 0 0 40 0 0	35 0 0 50 0 0 60 0 0	... ...	... .	
Sal bed posts 7' × 2½" × 2½" ...	10 0 0	15 0 0	...	...	
Bamboos of 9' to 10' per 100 score ...	...	...	50 0 0	137 0 0	
MORADABAD.					
Sal 10' Tors (Poles) ...	20 0 0	25 0 0	...	...	
Sal & Sain, &c., Kuries 12' × 5" × 4" ...	30 0 0	50 0 0	...	...	
Sal bed posts 7' × 2½" × 2½" ...	0 8 0	0 10 0	...	...	
Bamboos of 9' to 10' per 100 score ...	...	...	50 0 0	75 0 0	

The Teak Market.

Messrs. Denny, Mott, & Dickson report deliveries from the docks in London last month were 706 loads, as against 1,372 loads for the corresponding month of last year. 389 loads were landed during the month, and stocks now show as follows :—

	1894. Loads.		1893. Loads.
	5,154	logs	7,782
	2,006	planks	3,079
	26	blocks	25
Total	7,186		10,887

or decrease of about 34 per cent. on last year's stocks in London.

The following are the comparisons between the past half-year and the corresponding one of 1893, *viz.*, from 1st January to 30th June.

	1894. Loads.	1893. Loads.
Landings in London Docks	5,970	10,419
Deliveries from London Docks	5,958	6,648

showing a decrease on the half-year of nearly 43 per cent. in the landings, and fully 10 per cent. in the consumption.

The arrivals of teak to Europe for the half-year ending 30th June have been some 25,000 loads, as against 17,000 loads for the corresponding period of last year, showing an increase of about 32 per cent. for the half-year, which have been chiefly due to the hurrying forward of cargoes against the requirements of H. M. Admiralty.

The supplies afloat and chartered for arrival this year are practically the same as those provided for in the corresponding half-year of 1893. It will be seen from the above statistics that the supplies have been more than adequate to the needs of the market, owing to the falling off in the demand for consumption during the last three months, the improvement in the demand for shipbuilding shown during the first three months of the year not having been sustained, whilst the rolling-stock demand has been of the most restricted description since the autumn of last year. That the railways cannot indefinitely prolong the starving of their rolling stock is clear, and perhaps an improvement in this direction is nearer than is generally contemplated, and may be more logically hoped for than in the direction of shipbuilding, in the face of present low freights and the enormous supply of tonnage afloat. Were it not for the growing demand all over Europe for teak for naval purposes, the prospects of the market would be discouraging; but as naval "programmes," both here and abroad, tend to develop, the present level of prices may be sustained, if not improved upon.—(*Timber Trades Journal, July 14th, 1894.*)

Churchill and Sim's Circular.

August 8th, 1894.

East India Teak.—The deliveries for the first seven months of the year came out at 6,937 loads, as against 7,626 loads for the corresponding period of 1893. In July this year they were 886 loads, and in July, 1893, 1,062 loads. The London stock has diminished in the month, but the fear of heavy imports some time ahead keeps down prices. Probably these fears are exaggerated; the visible supply though distant, is large, but it is well accounted for by Government requirements in all parts of Europe, and the surplus should hardly overtax the regular commercial demand, feeble as that undoubtedly looks at the moment. The quality of some recent Burmese shipments has not given complete satisfaction, and rumours are current from Siam of difficulties with the flotation of logs to the coast to load vessels chartered.

Rosewood.—Is of slow sale and stocks sufficient.

Satinwood.—For finely figured logs good prices could be made.

Ebony.—Large, good logs would realize fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superficial	6d.	to	12d.
Rosewood	,, ton	£5.	to	£8.
Ebony	,, ton	£6.	to	£8

MARKET RATES OF PRODUCTS.

Tropical Agriculturist. August, 1894.

Cardamoms	per ℔	2s.	to	2s. 6d.
Croton seeds	per cwt.	20s.	to	27s. 6d.
Cutch	,,	20s.	to	32s.
Gum Arabic, Madras	,,	15s.	to	30s.
Gum Kino	,,	£15	to	£18.
Indian Rubber, Assam,	per ℔.	1s. 7d.	to	2s. 2d.
,, Burma	,,	1s 7d.	to	2s.
Myrabolams, Bombay,	per cwt.	7s. 6d.	to	9s. 3d.
,, ,,	,,	3s. 6d.	to	4s. 3d.
,, Godavari	,,	6s.	to	6s. 9d.
Nux Vomica, good	,,	6s.	to	10s.
Orchella, Ceylon	,,	15s.	to	22s.
Redwood	per ton	£3. 10s.	to	£4
Sandalwood, logs	,,	£35	to	£55
,, chips	,,	£9	to	£20

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

2nd August, 1894.—No. 774F.—Mr. J. A. McKee, Conservator of Forests, Assam (on furlough), is transferred, in the interests of the public service, to the Central Provinces as Conservator of the Southern Forest Circle.

2.—Madras Gazette.

21st July, 1894.—Mr. J. Tapp, Acting Ranger, 4th grade, North Arcot District, to be Ranger, 4th grade, from 28th June, 1894.

31st July, 1894.—The following is the result of the Departmental Test held in July 1894 :—

Name.	Appointment.	District.	Subject in which passed.
C. Ramaswami Aiyengar ..	Temporary Forester, 2nd grade ...	Tanjore ...	Forest Act and Rules and Code and Accounts.
K. Kailasa Aiyar ...	Acting 3rd Clerk, District Forest Office ...	North Arcot	Forest Act and Rules.
V. M. Varadarajulu Naidu .	Acting 4th Clerk, District Forest Office ...	Do.	Do.
J. S. Cornelius ..	Third Clerk, District Forest Office ...	Salem ..	Forest Act and Rules and Code and Accounts.
M. S. Arokyaswami Pillai ...	Forester, 4th grade	Do.	Forest Act and Rules.
A. Kaishna Row ...	Permit Clerk ..	Do.	Code and Accounts.
M. Ponnuranga Mudaliar ...	Forester, 4th grade	Nellore	Forest Act and Rules.
C. Balaya Naidu ..	Do.	Cuddapah	Do.
K. Ranga Row ...	Range Clerk ...	Salem ...	Code and Accounts.

2nd August, 1894.—A. P. Ramachandra Mudaliar, Ranger, 5th grade, sub *pro tem*, to be Ranger, 5th grade.

Under orders of the Board of Revenue the services of Ranger Mr. J. Tapp are placed at the disposal of the Court of Wards for employment in the Jeypore Estate, Vizagapatam District.

S. Ramaswami Aiyah, Forester, 1st grade, to act as Ranger, 5th grade, sub. *pro tem.*, *vice* Mr. Tapp on deputation.

31st July, 1894.—Under Article 291 of the Civil Service Regulations, S Eggia Narayana Sastri, Acting Forest Ranger, 5th grade, Anantapur District, is granted 20 days' privilege leave, with effect from the date of availing himself of the same.

2nd August, 1894 —V. P. Ramalingam Pillai, Forest Ranger on Rs. 125, North Malabar Division, is granted leave on medical certificate, under Article 369 of the Civil Service Regulations, for three months from the date of relief.

THE
INDIAN FORESTER.

Vol. XX.] October. 1894. [No. 10

Note on the use of Simul wood for Tea boxes in Assam.

The wood of the Simul tree (*Bombax Malabaricum*) is used extensively in Assam for tea boxes, as the following figures prove :—

Number of boxes on which royalty has been paid during the Forest year, 1893-94 :—

Lakhimpur division	2,48,816
Sibsagar „	29,572.
Darrang „	89,935.
Total	368,323.

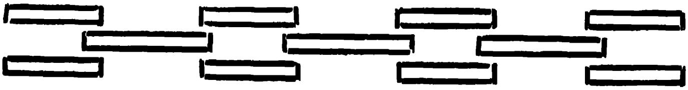
During the same period of 1892-93, the number of boxes on which royalty was paid amounted to 322,676, and in 1891-92 the number was 303,924; these figures show a steady increase, but they do not represent the total trade in tea boxes, as in some districts trees are sold for this purpose, and some boxes are made from timber on private estates, as explained in the Forest Administration Report for 1892-93, para. 95.

In the Lakhimpur division there are six saw-mills constantly at work: (1) Mukla, (2) Sissi, (3) Oriental, (4) Balijan, (5) Bokel and (6) Tapajan. In the Sibsagar division, on the left bank of the Dehing river, there are two mills, (1) Hopewell and (2) Dehing; and in the Darrang division, there is a branch of the Sissi mills at Tezpur.

The Sissi Saw-mills and Trading Co., Limited, being the largest of those concerns, may be taken as a type. They work on what is called the "box royalty" system which may be briefly described as follows :—The Manager of a mill is supplied by the forest office with permit books, and he issues permits to contractors to fell Simul trees in the unclassed State forests within the division. The trees are felled and logged during the cold weather, and are floated down during succeeding months to the mills, which are all situated on waterways. The larger the girth of the log the better for the mills, the length is generally 8 to 10 feet. The rafts of logs are kept in the water until they can be sawn up. The logs are first ripped up in a frame saw, and then pass through a variety of circular saws until they emerge as "shooks," *i. e.*, the actual pieces of which the box is constructed. These "shooks" are of varying widths and lengths to suit the different sized boxes, which are classified as follows:—*Large*, 24″ × 20½″ × 20″ outside measurement; *Medium*, 22″ × 19″ × 18″; *Small* 20″ × 16″ × 16″, and 18″ × 15″ × 15″; also *cubes* 16″ inside measurement. The Sissi saw-mills also prepare boxes of the Japanese size 24″ × 20″ × 19″; and special sizes are cut to order at an enhanced rate of two annas a box. The prices charged at the branch saw-mill at Tezpur, which is situated on the Brahmaputra, are, for large boxes, 14 annas each; for medium 12 annas; and for the small boxes and cubes 8 annas. Corner pieces, and battens are supplied free of charge with each box.

The method of seasoning is as follows:—First, the logs themselves remain in the water for two to three months; if they are kept longer in the water they develope a peculiar unpleasant odour, which is got rid of with great difficulty even when the logs are cut up into shooks. It is found impossible to season the logs on dry land as they soon rot; so the general plan is to saw them up soon after their arrival at the mill, when they have perhaps been in the water one, two, or three months according to distance, number of logs in stock, &c.

Directly the "shooks" are sawn up they are stacked on end out in the open, four together, and turned every now and then for a fortnight, by which time, if the weather has been fine, they are quite dry; and they are then stacked in an open shed, so that air can play between them in the following manner:—



Even with these precautions, if the boards are kept stacked for any length of time, they develope dry rot to an alarming extent; and they are also liable to be attacked by a small beetle locally known as the "Ghong," which is probably a species of Bostrichus. The only remedy for the latter is to watch the stocks, and remove any boards which show signs of the insect, and burn them. For the former there is no remedy. Consequently, the object of the mill Manager is to get rid of his boards as soon as they are sufficiently seasoned. In the busy months, June-September, there is no difficulty in this, as the indents received keep the mills at work from 17 to 18 hours a day, and the difficulty is to supply tea gardens fast enough. But before these indents come in, a large stock is liable to accumulate, and there is always a good deal of loss.

In case of emergent indents, boards are sometimes despatched from the mills before they are thoroughly seasoned, and in this case a warning is sent with the consignments, and a careful garden Manager will unpack them at once and subject them to further drying in an open shed. But as a rule only seasoned "shooks" are despatched from the mills, and they can be made up into boxes at once. At the time of despatch the shooks are tied up into bundles, containing sufficient boards for four boxes, but this rule is not invariable.

It is not considered advisable to place the boards in water, this always discolours them, and planters would reject them. The best plan is to keep them perfectly dry, in a well ventilated shed, and to use them as soon as possible after they are once seasoned; one month is quite sufficient for this process, and there will seldom be any "cheesy" odour about the boards if the above precautions are attended to.

The saw-mill managers distinguish between *red* and *white* Simul wood; the former, known locally by the natives as the male tree, gives the best boxes, but it takes a little longer to season; the latter, known as the female tree, is also used, it is said to have a more open grain and to season more quickly.

Occasionally logs of other woods are brought in by mistake for Simul, and some of these have a most unpleasant odour like rancid butter, notably a wood called "Kaddam" or "Makai," a specimen of which has been sent to the Director, Forest School, for identification.*

The Mill Manager's books are open to inspection, and are frequently inspected by the Forest officer, and a statement is supplied every 10 days or so, shewing the—

No. of logs received and sawn up daily.
No. of boxes turned out daily.
No. of boxes delivered daily.

Payments are made to the Forest Office on "deliveries" (*i. e.*, boxes despatched) at the following rates:—

Large boxes at	1	anna each
Medium ,,	9	pies
Small ,,	6	pies

Scantlings @ 1 An. 3 pies per c. ft.

The total revenue received from this source in Assam during he forest year 1893-94 was Rs. 20,016.

---

* *Note*—It has proved to be the wood of *Anthocephalus Cadamba*, a tree whose wood certainly had no previous reputation of the kind.—*Hon. Ed.*

There is no doubt that well seasoned Simul is a favourite material among the tea planters for boxes, and as the tree is very fast growing, there is not much chance of the supply being exhausted just yet, though the contractors have to go further and further from the mills every year.

A. SMYTHIES.

The above was received from the Inspector General of Forests who has been making enquiries on the subject of the use of 'Simul' wood and other woods for tea boxes. He has also sent us a letter from Mr. Fordyce now in charge of the Andamans Forests, who writes as follows :—

Most of my experience regarding the use of Simul wood for tea boxes was gained in Assam, and I had a good deal to do with inducing the planters to set up the saw-mills now existing in the Lakhimpur District. Neither planters nor the owners of saw-mills are very particular what wood is used for tea boxes, as long as it fulfils certain conditions. The following are some of the woods I have seen used :—

Simul (*Bombax Malabaricum*), Raghoo (*Anthocephalus Cadamba*), Sontiana (*Alstonia scholaris*), Hollong (*Dipterocarpus pilosus*) &c., &c.

Hollong is one of the woods that, if not thoroughly seasoned, has an acid reaction on the lead, forming a white precipitate, and ultimately entirely destroying it. The chief wood used in the biggest saw-mill was Simul.

For the Sissi mills contractors fell chiefly Simul, it is cut along the banks of the Brahmaputra river, and thrown into the water, where it is made up into rafts and floated down to the mills. Here the timber lies in the water until required for cutting up. It is then taken straight into the mills and cut up into shooks of the required size. These shooks are then taken off to a long thatched drying or seasoning shed, where they are packed carefully with spaces between each shook, so as to allow the air to circulate freely between the boards.

If the weather is fine these shooks are often taken out and stood on end in threes or fours in the open air. After the shooks have undergone this process for a certain time, they are put into bundles, tied round with cane, and despatched to their destination.

On arriving at their destination some planters, I believe, open out the bundles, others leave them as they arrive, until required for making into tea boxes.

It is very hard to say how long the Sissi saw-mills keep their logs in the water before sawing them into shooks. This depends a good deal, if not entirely, on the supply of timber they may have in hand; and I feel quite certain that it is not for seasoning purposes, but purely as a matter of convenience that they are left in the water; as situated where they are, they can in most months float the timber right up to the mills, and this facilitates the handling of big logs enormously. However, on an average, I should say their logs were in the water at least a month before they are cut up.

Then again arises the question how long the shooks are in the process of drying and seasoning before they are despatched to their destination. This time again varies. At the slack time of year, the shooks will be kept under this process longer than in the busy season, when, very often there is a sudden demand for boxes, when the drying process is reduced in time as much as possible.

My estimate of the time the shooks are drying and seasoning is from two to four weeks in the Sissi saw-mills.

At other saw-mills, *i. e.*, "Planters' Stores" and "Dehing" saw-mills, I have seen "Simul" logs taken out of the water immediately they arrived, and put through the mill and cut up into shooks. This timber could not have been in the water a week, and probably only two or three days. The latter saw-mills were often very hard up for timber, and in many cases their shooks must have been despatched to their destination after only three or four days' seasoning and drying.

Again I would mention the case of Mr. Peal's mills. Situated as they were, timber could not be rafted to them. The timber (Simul) for these mills was dragged direct into the mills, so that the logs were never in water at all. Here the logs were stacked close to the mill, and were very often cut up more or less green, and the shooks seasoned in a drying shed.

I have never heard of "Simul" being cut up into planks and then being put into water. I don't think any advantage would be gained by doing this.

In the Andamans we use what is said to be "*Bombax insigne*" for cutting up into boxes for the local tea garden. The logs we use have been in depôt for two years or more, Chester having used them for floating down "*Lagerstrœmia hypoleuca*" and "*Pterocarpus Indicus.*" These logs are not sound, and ever since they have been in depôt, they have been constantly submerged at high tide. We take these logs over to the mill, floating them over, cut them up at once into shooks and let them season, as a rule, for about three weeks under cover.

Drawing my conclusions from the above facts I should say:

1st—That water seasoning, either before or after sawing Simul, is not necessary.

2nd—That if water seasoning is done it should be done in the log.

3rd—*That* after *Simul* has been cut up into planks or shooks, 3 to 5 weeks in a covered drying shed is sufficient seasoning for all practical purposes, for the making of *tea boxes.*

4th—In dry, fine weather the drying and seasoning process can be greatly helped by standing the shooks on end in the open.

C. FORDYCE.

In the Darjeeling Terai, it used to be the custom for planters who used Simul wood, or other soft woods like *Anthocephalus Cadamba, Canarium bengalense, and Duabanga sonneratioides* to cut them up into planking immediately after felling, stack them on end for a while, and then make them up into boxes. In Dehra Dún there is too great a prejudice against Simul wood, to allow of its use, if it were to be regularly used it would be advisable to plant, for there are many areas of land which will not grow Sal, but which would grow Simul excellently. As regards the colour and quality of the wood, we believe that seasoning, either in water or not, is a mistake, as it has the effect of discolouring the wood. To keep it white, we believe, it ought to be cut up at once after felling.—*Hon.-Ed.*

Influence of Places on Spirits.

Have you ever experienced, on reaching certain places when on tour, a buoyancy of feelings, whilst on reaching others a depression comes over you. I ask this question because I think that the buoyance or depression arises from a variety of causes; and the experiences of many persons would provide interest, amusement, or sympathy, as the case may be. Of course, frequently, the causes of depression or buoyancy are palpable on the face of it; for instance a person has heard that a certain place is dead-alive, and he naturally is depressed in going there; the more so if he finds that his experience is that of his informant.

Again, previous experiences rather tend to bias one in favour or disfavour of a place; thus a person who has had some great mishap in a certain town, for instance, will generally, although he may have liked it well enough prior to the mishap, think it is unbearable after the occurrence.

Moreover, one's state of health is apt to imbue the locality with favourable or unfavourable feelings, as the case may be. Finally, the state of the weather is apt to influence. The combination of these influences, and many more, makes a marvellous variety of impressions, and there is invariably a liability to alter our opinions in regard to a place whenever these conditions are in any way changed.

For instance, a friend of mine heard that the Trossachs in Scotland was a lovely piece of scenery. He arrived there on a wet afternoon, and rather out of sorts; and thought that, at least, it was decidedly commonplace. He went there a second time in good spirits on a fine day, but expecting nothing out of the common, and found it as nearly perfect as could be seen.

Again consider the haunts of our youth, not visited from an early age until we have reached manhood. Lakes dwindle into ponds, palaces into petty country houses, and so on. But what I specially refer to are cases where there are no especial reason for buoyancy or despondency. I have been out but 6 days from head-quarters, and on two occasions I have felt a feeling of buoyancy on arriving at certain camps, whilst at another I have felt decided depression. The depressing place I have been to upwards of twenty times, and always felt the same feeling more or less. The first time I went there I had received a glowing account from a late official in the district, after whom one of the suburbs was called. But before arriving there I experienced a horror at reaching it. My horror on that occasion were fairly justified. We—that is, wife, two children and self—arrived the other side of the rapid large river, that borders the town, just as the sun was setting. We had to be paddled across the raging torrent, for the river was very high, in a small over-crowded hand-paddle boat. We reached the opposite side, after sundry shipments of water, when it was dark, and we were then 2 miles from the dâk-bungalow, which had to be reached on foot over a desolate, sandy tract. On reaching the bungalow, no one was there; and when some one did arrive half an hour later, we learnt that the departmental boat had been taken off the day previously to the next district by the Conservator, and we should have to travel down in a native craft. However, our woes came to an end, the children slept, we had dinner, and at its close we learnt that the departmental boat had been returned by the Conservator. Moreover, the scenery from the river, especially at sunset, is beautiful. And yet everytime I go there I get this fit of depression on reaching it, although the congenial people I meet there speedily drive it away.

The first place on this tour, when I became so buoyant, I had never been to before, and knew nothing about. On inspection when the day broke, (I was travelling by canal), I found a medium sized native village completely surrounded by water, as the canal had overflowed. why then should I have been so joyous ?

The next place I had passed before in my boat, but never stopped at. In my previous passages past it, it had certainly looked lugubrious enough, nor can I find, even after my fit of buoyancy, any real cause of joy for arriving there.

RAHDARI.

Forestry and Sylviculture.

The following is a reprint of the greater portion of a lecture given by Mr. D. E. Hutchins, Conservator of Forests, at Cape Town, on the 20th June, 1892 :—

In the Cape Colony and the Transkei we have about 550 square miles of high timber forest, and there is a larger area of scrub forest of which it is difficult to estimate the value or even the area. We shall dismiss this in a few words. It will not pay either to conserve these scrub lands strictly, or to survey them accurately ; and in many localities they are of less value, either for forest or for grazing purposes, than would be open land of the same area. Of such is the Addo Bush, and the scrub lining the valley of the Fish River and other rivers on the eastern side of the Colony. The high timber forests of the Colony, leaving aside a small area of poor forest on the coast of the Alexandria Division, occur within the Colony in two localities, *i. e.*, at Knysna and the Amatolas. The Knysna forests stretch along the flanks of the Outeniqua mountains between George and Wit Els, near Storms River. The Amatola forests lie at a higher level and clothe, more or less continuously, the southern slopes of the Amatola mountains to the north of King William's Town, extending with the continuation of the mountains from near the Kei River to the Fort Beaufort division north of Grahamstown. Within these two groups of forest about four-fifths of the total area of forest still remained at the disposal of Government when the Forest Department was put on its present footing in 1883. Since that time there has practically been no further alienation of forest ; and the Knysna forests and the Eastern forests have been definitely constituted and set aside as a national trust. They have been placed in the charge of professional forest officers, and are now managed as are the forests of France and Germany. On this system the forests are being gradually improved instead of being destroyed, and no more is taken from the forests than the normal growth of the forests is calculated to yield. Mr. Theale in his able history of South Africa gives the popular view of forests in this country. Vol. I., page 182 :—

"All our indigenous, useful timber is of exceedingly slow growth, and the best is found in situations difficult of access. A South African forest is composed of a variety of trees mingled together, in which it rarely happens that half-a-dozen of one kind are found growing side by side. Gigantic creepers twine among them, and the spaces between the trunks are filled with tangled underwood and enormous ferns, so that one cannot proceed far without the aid of the axe.

"In such a forest the woodman fells a tree, which in its fall clears a large open space, where afterwards only a useless scrub springs up. To get the log out a pathway must be opened broad enough for a team of oxen to move in, and straight enough to prevent jamming. For this purpose a great number of smaller trees must be cut down, so that the quantity of wood contained in a wagon or the roof of a house represents but a very small percentage of the quantity deducted from the forest, and of that none is ever replaced. In this way the forests of Knysna and Tzitzikama, of the Winterberg and Amatolas are disappearing now just as those in the Cape Peninsula disappeared two hundred years ago. They cannot be used and preserved too, as in countries where timber is of rapid growth, or as artificial forests, where waste can be avoided."

This quotation states in a few words the historical view of the subject. We foresters claim—and it is a claim that anyone can satisfy himself about by taking a walk through the forests—we claim to be using and at the same time improving the forests in our charge.

The forests at Knysna and along the Amatolas are managed on this system. The larger forests are divided up, and the small forests grouped together into a working unit called the "Series." In the Knysna Conservancy there are thirteen Series, with an average of about four thousand acres each. Each Series is divided into forty equal parts termed Sections, so that these Sections average about one hundred acres each.

One of the series in the Knysna Conservancy—that nearest George—has been so much overworked in the past that it has been entirely closed for the present. So that there are now open and being worked at Knysna twelve Sections, averaging a hundred acres each. Each year in each Series a fresh Section is opened. It will thus take forty years to work through each Series, and at the end of that time the Sections first opened for working in 1883 will again have mature wood grown up in them. When a forest Section is worked not all the trees are cut down but only those that are mature. Who is to judge what trees are mature? In this lies the pith of the whole matter. If you leave the judging to the wood-cutter, as in the old days, he will very naturally judge those trees mature which suit his own convenience. He will pick out the best trees and leave the worst to grow and form the forest of the future: he will overwork and destroy the accessible forest and leave mature timber to rot in the inaccessible forest. To avoid these evils, each forest Section, before being thrown open to the public, is thoroughly and closely examined by the Forest Department. Every tree in the Section is inspected, and those which, *looking at the future of the forest*, should now be felled are numbered, measured, and entered in a book kept for the purpose. This is a long and tedious business, and occupies the Conservator and Foresters for several months. We are always glad when it is over. It is pleasant to walk through a marked Section. At about every hundred yards (the distance depends on the density of the forest) lines termed virées have been cut to guide the workers. As one walks down these lines, or along an old slip-path, or occasionally along an elephant-path, the trees marked for felling come into view. Each of these trees carries a large cross in red paint high on its trunk; at its foot half-buried in fern and beautiful foliage is a number also in paint, and below all, probably on a gnarled root, is the Government stamp. With a little practice you will be able to see why each tree marked for felling has been selected. Here is a hoary old giant of several centuries' growth. His massive limbs were flung out very much as they now are when the white man first came to the country; his bole runs up straight and cylindrical for forty or fifty feet like the columns in the aisle of a Cathedral. No one cared to tackle him under the free selection system. He may be still good timber, or he may be a mere shell and too rotten already to work with profit. It is easy to see why *he* has been marked for felling! By his side perhaps stands a slender stripling. We wonder why *this* has been marked for felling. Surely it will be worth much more in forty years. But it bears the fatal red cross; and we look again. There on the other side of the trunk is a black streak; higher up a decayed branch. That tree is rotten at the heart. It must be cut down to make room for a sound tree. Whatever value it has is in the present. In marking the trees for felling in a forest Section this is the principle followed:—*Unless there are cultural reasons to the contrary every tree is marked for the axe that will not in forty years increase in value more than its present value put out at interest at four per cent.*

Before a tree is marked for felling one has to look on the ground and look around to see what there is to replace it. No forester, if he can help it, makes a large gap in the forest. A gap in the forest is a dangerous thing, It lets in wind and sun. Wind may blow down the surrounding trees; sun is more to be feared—it deteriorates the forest soil, induces a growth of grass and inflammable herbage. A sudden exposure to sun will kill the seedlings of forest trees. Stinkwood is especially tender in this respect. So you see that when a Forester plods down the virée lines day after day, marking the trees that are to be felled next year, he has plenty to think about, plenty to do; and when each year's Section of forest has been completely examined, the most arduous part of his duties for that year is over. His work is checked by his superior officer, the Conservator, who, book in hand, checks 10 per cent. of all of his measurements, and criticises his selection of trees for felling.

Everything being now ready the forest Sections are thrown open to the public on the 1st of March in each year. The forest remains open for felling till the following June. All timber has to be worked and got out of the forest by the end of December: 15,000 trees on an average are thus felled yearly in the Knysna Conservancy. The average size of the timber from these trees varies according to the quality of the forest. In the Gouna forest near the port of Knysna, where it is almost virgin forest, the average of the trees felled is 56 cubic-feet each. In the poor forests near George and Plattenberg Bay, in forest that has been overworked and irregularly worked for fifty years, this figure falls from 56 cubic-feet per tree to only 12 cubic-feet, and as low as 8 cubic-feet at Wit Els, the end of the forest country towards Humansdorp.

Each Section remains open for two or three years. It is then put in order by the Forest Department and closed for 40 years. Planting and thinning, more or less, according to circumstances, are required to put a Section in order. As a rule planting is only required at Knysna in case of accidents, such as forest fires. If all goes well, no planting is required. Thinning is always necessary. The thinning done at Knysna is called "improvement thinning." Its object is *not* to decrease the number of stems per acre, but to favour the more valuable species. The value of the different woods in the Knysna forest varies much. There are a number of woods that are practically valueless. There is one wood that sells at 1s. per cubic foot as it stands in the forest, a wood for which there is an unlimited demand, and a wood that we might send all over the world if we only had enough of it. I refer of course to Stinkwood. By improvement thinnings we can produce Stinkwood trees at a cost of about three farthings per tree. This is the way it is done: the Forester goes over the forest with three or four wood-cutters and wherever he finds young Stinkwood seedlings dominated by inferior species he fells or rings the latter, and sets free to the young Stinkwood trees. Only those who are familiar with the social economy of a close forest can appreciate the force of this operation. Charles Darwin in his masterly way describes the struggle in a close forest: in the animal world the struggle is mainly for food; the fittest survive. In the forest world struggle is for light. When we ring or kill an inferior species in the forest and so let in the light upon a dominated Stinkwood seedling, the practical effect is that a Stinkwood tree is produced. As I mentioned above, the average cost of this work is about three farthings per tree produced, so that it is more remunerative than any planting. It is also more certain since a tree is produced with the surroundings and on the spot where nature has placed it for thousands upon thousands of years back into the dim distance of geological time! It would take up too much space were I to attempt to describe severally the beautiful woods in our forests. I may just mention that Stinkwood is the valuable tree of the Knysna forests, and Sneezewood of the Eastern forests. In the Transkei both of the woods are found. In the Colony Stinkwood is found only to any extent in the Knysna forests, and Sneezewood only in the Eastern forests. The two species of Yellowwood constitute about 50 per cent. of all the timber in the forests. The two wagonwoods—Assegai and White-pear—occur throughout the Colony and the Transkei; but they are never abundant, and would in course of time become extinct, but for the cultural operations now undertaken in their favour. Ironwood is everywhere superabundant. It is hard to find outlets for it. It is a very beautiful but very hard wood. For general planting purposes our indigenous forest trees have not much practical value. They are all slow-growing, and do not thrive away from the damp equable climate of the coast and the mountain ranges facing the sea.

Before quitting the Knysna forests, I must say something about the sleeper industry of Knysna. In most respects this is the most successful of all Colonial industries. It was begun in 1884, and during the last four years, one hundred thousand sleepers have been turned out yearly at an average cost of 5*s*. 5*d*. per sleeper. The average cost of the sleeper imported from England has been 5*s*. 6*d*., *or one penny dearer*. Wood is worked at Knysna under difficulties, especially in the matter of roads and transport that do not exist in Europe, so that in producing in the Colony a sleeper cheaper than can be imported, the result achieved is one that we may well be proud of. And this is not all. The Colonial sleeper is not only cheaper than the imported sleeper, but it is a better sleeper. It is harder, and so resists wear better. As to its durability, we have the best possible guarantee since we creosote it ourselves at Knysna. In the imported sleeper we have no such guarantee, and I am sure I shall betray no confidences when I tell you that many imported sleepers have come to this country with only a layer of creosote on the outside. They have been put on to the Railway, and I have seen them taken out still sound on the outside but rotten inside. Such a sleeper besides being a fraudulent article is dangerous to lay a line on. A formal promise has been given that no more wooden sleepers shall be imported. Some people will tell you that the days of wooden sleepers are numbered. I do not think so; and I am in a position just now to speak with some degree of confidence on this subject. The summer before last I made a tour through Germany, Switzerland, Holland, Belgium, and parts of Austria and France with the express purpose of renewing my acquaintance with the forests and of studying the sleepers used on the various lines of railways. I found that iron sleepers were making their way very slowly. In Switzerland and some of the German States, one-fourth of the total extent of railweys was laid with iron sleepers, but this was the highest proportion. There are objections to the use of iron sleepers which have not yet been overcome, and probably never will be. The iron pot sleeper is clumsy and is used less now than it was 20 years ago. Various patterns of bent sheet iron sleepers are now being tried, but these are all much more expensive than wooden sleepers, they do not give such a good permanent way, and their exact durability, as compared with wooden sleepers, remain to be tested. I have seen the rust coming off some of them in thick scales. Until a galvanised sheet iron sleeper can be produced at a moderate cost, I believe that wooden sleepers will always hold their own. The great railway companies in England, with the finest railways in the world in their charge, will have nothing to do with metal sleepers. Our Colonial railways are, however, more like those on the Continent of Europe, and it is to these we must look for guidance in the matter. They, as I have mentioned, are adopting iron sleepers very slowly; and I cannot but think that we should do well to imitate their caution, and not, as at present, use only iron sleepers for the new railways in the interior, and for renewals on Colonial railways a short distance away from the coast. In the Karoo, iron sleepers are of course at their best, but in damp, warm climates they rust very rapidly. For our forests, the sleeper question is one of very great importance. Sleeper wood and other woods grow side by side in the forests. As long as the sleeper woods are utilised, the forests are worked at a profit. If we have to leave the sleeper woods to rot as was the case before 1884, it is so much loss to the forest revenue, and to the public who are the owners of the forests. Even more important than this is the money spent in the Colony instead of being sent away to pay for imported sleepers. Every year that the normal supply of 100,000 sleepers is taken from Knysna £24,000 are spent on Colonial wood and Colonial labour. And lastly, there is this point about the sleeper industry, the *labour is nearly all white labour.* I do not think there is any other Colonial industry quite in the same position in this respect.

Sleepers as yet are not produced from the Amatola forests, although there they could be produced cheaper than from Knysna, since the railway passes through the end of the Amatola Mountains, and on to the Port of East London where the creosote could be landed.

In the description of trees growing in them the Amatola forests differ little from the Knysna forests. As I have mentioned, imperishable Sneezewood replaces the valuable Stinkwood; and, as always happens, the variety of species increases. This is not usually an advantage. The Eastern forests are managed on the same general system as the Knysna forests. Natural reproduction is not so good as in the Knysna forests, and more is spent on plantations. Where the railway passes through the Eastern end of the Amatola Mountains, at Fort Grey, there is a very extensive and flourishing group of plantations. These plantations being on the line of railway are very favourably situated for taking wood up to the treeless country to the north. The demarcation of the Eastern forests fell to my lot in 1883. We had a difficult, and to some extent, a dangerous task. The memories of the last Kafir War were still fresh. The Fingoes and Kafirs had patched up their difference, but no one felt quite sure how long this would last. For the time being, both were cultivating the arts of peace, which, as regards the forest, was very rapid destruction. Mealie gardens were eating into the forest in every direction. Frequently several forest fires could be seen at one time, all proceeding from the same cause, the felling of the forest for native gardens. I knew exactly what was required. I had ten years' experience of this sort of thing in India. We pitched our tents and got to work in a few days. We laid out our lines of demarcation, erected our beacons, and mapped out permanent boundaries for the forests. For the first year or so little opposition was shown. Then the "native mind" became aroused. There is something mysterious and awe-inspiring about this phrase "the native mind." More is usually known about it at Cape Town than on the frontier. It is an intangible and immeasurable quantity. No man may tell its exact height, breadth, and depth. But in 1885 we felt its power. For some time it looked as if our work, and with it the forests, would be abandoned to destruction. Then better counsels prevailed. A Government Commission was appointed which, after long and close enquiry on the spot, practically confirmed all we had done. Our demarcation lines remained, and the forests were saved! The forests now had definite boundaries, and as soon as a man and an axe crosed these boundaries he had to justify himself before the magistrate. Then arose another difficulty. Here were forests, forest officers and magistrates, a plentiful crop of forest offences—but no forest laws. Many of our magistrates are negrophilists and in their hands forest protection on the frontier was little more than an expensive farce. This was remedied by the Forest Act of 1888.

In the Transkei, Forestry is beset with many difficulties. Considering the state of the country good progress is being made in demarcating and conserving the forests. That an efficient check is now being placed on the fearful forest destruction that prevailed there a few years ago is shown by the long yearly roll of successful forest cases.

[At this point of the lecture large polished specimens of all the valuable Colonial woods were shown, one by one, and descriptions given of the trees that produced them]

I shall now throw on the screen some views of Colonial forest trees taken in the forest under my supervision.

No. 1.—A Yellow wood tree. It dees not look so big in the picture as it is in reality.

No. 2.—Red Els, growing on top of a mountain on bare rock. It is quite certain if that tree were not growing there, nothing else would.

No. 3.—Wild Lemon tree.

No. 4.—Tree from gorge, Pirie forest.

No. 5.—An overworked forest, ripe for fire—portion of Pirie forest.

No. 6.—Sneezewood and Kafir-plum trees, Perie.

There is one general feature running through all the views—the smallness of the bulk of wood per acre.

In this matter our forests are inferior to those of Europe. It is a failing that will decrease with the regularization of the forest now taking place, and the replanting of burnt forest. I should have mentioned that last year at Knysna rather more than 12 young trees were planted, mostly in burnt forest, for each tree felled.

In our indigenous forests, small though they are compared with the forests of other countries, we have a valuable possession. Unfortunately there is practically no indigenous forest near Cape Town, nor even in the west of the Colony nearer than Knysna, so that the tendency has been to neglect the indigenous forests in favour of plantations. Out of sight has too often been of mind. Then, too, from an administrative point of view, there has been the trouble with the local population living in and near the forests. These people gradually get to look on the forests as theirs—it is the same story everywhere—and to resent the necessary restraints required for the preservation of the forests. And thus it has come to pass that, relatively, too much attention has been paid to plantations, and too little to our grand, natural forests. We see and enjoy the one, the other is hundreds of miles away. The tree at our doors looks larger than a square mile of forest on the frontier!

But, if we put the matter to the test of figures, we see that our best plantations are mere child's play compared to the natural forests. If the 550 square miles of natural forest in the Colony and the Transkei were to be allowed to be destroyed, to replace them on the basis of present cost of plantations would require the enormous sum of nine million pounds sterling. Any such expenditure is of course entirely out of the question. The natural forest must either be preserved by careful and systematic management, as at present, or else inevitably lost to the country for ever. How easily the natural forest may in a few years be totally destroyed, we see in the history of the Katberg forest and the forest near George. The first was managed by Government, the second by the Municipality of George. In both, the felling was done under supervision and with the best intentions for the preservation of the forest. In both, east and west, the result was the same—final destruction by fire. The management of the evergreen forest of warm temperate zones is by no means an easy task. An amateur had much better try his hand at building a five-storey house or a modern ironclad!

A cause which has operated against forest conservancy in the Colony has been the prevalence of English ideas, and as English ideas have had, and will have, so much influence on forest conservancy in this Colony, I must say a few words on Forestry in England.

Forestry, as it is understood in France and Germany, is unknown in England. The average Englishman may be said to know about as much of forestry as a Chinaman of electricity. And the worst part of the matter is that he does not want to know anything about it. He wraps himself up in some trite free-trade maxims, remarks that land is valuable in England, and that it is cheaper to import timber from abroad. But now what are the facts? The beautiful forests of oak, beech and Scotch pine that once covered the greater part of Great Britain and Ireland are gone. Miserable mismanaged remnants exist in a few localities, but for all practical purposes the ancient forests of the two islands have ceased to exist. So completely have they disappeared that in the cases of some of the most famous old forests, antiquaries cannot now say for certain in what counties even they were situated. Since the time of William the Conqueror, forestry in England is one long sad story of ignorance, apathy and neglect. Barren mountains, dreary heaths, and profitless bogs occupy the waste land, and the tourist in search of the picturesque hurries across the channel whenever he can snatch a few days leisure. Now let us see what England pays for this waste of its resources. The tourists rush away from the desecrated land like rats from a sinking ship. Tourists spend a good deal, but the loss of their money is a mere flea-bite. For imported wood England now pays every year the enormous sum of fifteen million pounds sterling. During 1891 six and three quarter million loads of timber, valued at fourteen-and-a-half million pounds sterling, were imported. Sir Herbert Maxwell, in an article in the *19th Century*, tells us that a further sum of fourteen million pounds is paid annually for forest products, such as bark, turpentine, resin, nuts, &c. I have no details of these figures, and so shall say no more about them, but the fifteen million pounds paid yearly for imported wood has been discussed by Dr. Schlich (the Principal Professor of Forestry at Cooper's Hill), in a paper read in March, 1890, before the Royal Colonial Institute. I have also have had the advantage of talking the matter over with Dr. Schlich, and this is what he says :—Of the fifteen million pounds sterling paid yearly for wood imported into England, about three millions is for tropical hard woods that cannot be grown in England. The remainder, that is to say twelve million pounds sterling, is for wood that could be grown equally well in England ; and further, Dr. Schlich reckons that if the waste land of Great Britain and Ireland were under forest this quantity of wood would be produced four times over. So that twelve million pounds sterling are now paid yearly by English simply as the penalty for the blind neglect of its forest resources in the past.

To my mind the saddest part of the whole story is this : The twelve million pounds sterling that is paid to Russia, Sweden, France, Germany and North America has to be met somehow, and it is paid in manufactured goods, goods that are produced by the labour of the factory operative, that physically degraded type of humanity one sees in all big manufacturing towns. With the destruction of the forests in England have gone the stalwart men who once worked in them, to be replaced by the factory hand—weak-lunged, knock-kneed and sallow. One has only to travel through the forests of the continent and then visit a few of the large manufacturing towns of England to have this physical degradation of the race brought home in the most forcible and unpleasant manner. Dr. Schlich estimates that one million people live directly on the forests in Germany, and three million people on forest industries, the first earning in wages about eight million pounds and the latter about thirty million pounds sterling. But let us consider the one million people that live and labour in the forests. What a reserve of national strength ! They are fairly, most people would say sufficiently, educated ; and their healthy life in the open air and constant exercise preserves a physical development, a strength of frame, sinew and constitution that is rare in these days of machinery and easy chairs. Judging from what I saw at a recent visit to the forests of Germany and the big towns of England, I should say that England could better afford to pay twelve million pounds sterling a year to make good her wasted forest resources than to lose the broad-shouldered and muscular men who once worked in her forests. These are the men whom we value as colonists—men fitted to form the backbone of nations.

A very interesting table is given at page 54 of Dr. Schlich's Manual of Forestry. There he shows that in the matter of forests England stands below all the civilised nations of the world. In Germany 26 per cent., or just over a quarter of the whole country is forest Great Britain and Ireland follow after Portugal in the list with 4 per cent. of woodlands. Even this wretched 4 per cent. is not forest but parks and scattered ill-managed plantations, producing timber inferior to forest timber. Country gentlemen will tell you that plantations do not pay, and I am sure I am not surprised at it. The year before last I spent several days in rambling over the historical New Forest in Hampshire. It represents about 100 square miles (nearly the area of the Knysna Forest) in the heart of fertile England, condemned to perpetual sterility by Act of Parliament. The situation is very well put in the article I have mentioned already, by Sir Herbert Maxwell. It would be ludicrous if it were not so sad !

When the home-staying Englishman talks to you about forests and free-trade heed him not. England is rich and strong, but can she long stand this drain—*twelve millions sterling paid yearly to the foreigners for wood that would be better grown at home, and her strongest men turned into hysterical factory hands ?*

The wealth and strength that Germany draws from its forests are astounding. Travelling through southern Germany from east to west, one is never out of sight of forest ; at one time surrounding us with the breath of its poetry and beauty touching us; at another clothing with wealth otherwise barren ranges of mountains. One traverses villages where the inhabitants have their firewood and fodder free, their rates and taxes paid for them, their school and libraries built, out of the revenue drawn from the village forests. This is an important point to remember. In France, Germany and Switzerland (two of these States, Republics) the communal forests belonging to villages are managed by Government forest officers, and the proceeds handed over to the villages. Taking Germany and Austria together there is a trifle over one acre of forest per head of population. Though the forests of

Germany, France and Switzerland have been managed on the present system for one, two and sometimes three centuries, there has been a steady increase in the quality of the timber during the last half century.

The dwellers in climates warmer than Germany derive an additional advantage from their forests in the improvement of the climate and the increase of the water supply. A long series of carefully conducted experiments has shown that forests do materially modify climate. (1) They render it several degrees cooler. (2) They render it less brusque, *i. e.*, less subject to extremes. (3) They slightly increase the rainfall. (4) They largely increase the yield of springs. These are benefits in which countries, situated as is Cape Colony, participate to the fullest extent.

Comparing Colonial forests with the forests of Europe and North America it will be seen that we are at a disadvantage on the following points :—

(1) Absence of pines—It is calculated that 9-10ths of all the wood used in the civilized world is pine wood. Pine wood with its tissue more or less full of turpentine and resin has a distinct advantage over the empty tissue of yellowwood. It is this emptiness of tissue that, more than anything else, renders yellowwood so liable to warp.

(2) Superabundance of useless hard woods, specially Ironwood.

(3) Want of access to forests.—It is only two years since purely forest roads have been made at Knysna. These roads cost from £60 to £80 per mile, and usually pay the total cost of construction in the wood brought over them in one or two seasons. The waste in working wood without roads at Knysna has been almost incredible. How such a state of things could have lasted so long is most extraordinary, considering the forest roads in Germany.

When all is said, the main difficulty in the way of the more extended utilisation of the Knysna forests lies in the difficulties of transport. To these difficulties of transport on land are added excessive charges for sea transport. It costs (within two or three half crowns per ton) as much to bring wood from Knysna to Cape Town as from Europe to Cape Town.

The extension of our forest resources opens up an almost boundless field of usefulness ; it will slightly improve the climate ; it will largely increase the water supply ; it will afford profitable employment for a large number of people—employment that will keep the people in the country and on the soil as in Germany, France and Switzerland, and not force them into the big towns as in England and Australia. Lastly, our forests are a very solid slice of national wealth. They are now being regularised and improved on the German system, extended by plantations and opened up by roads. Last year the Forest Department at Knysna planted at the rate of twelve trees for every tree cut down, and made two forest roads. The revenue from the Knysna

forests has doubled during the last five years; and is now sufficient to cover all ordinary expenditure. It will not be the fault of the Forest Department if there is not soon a handsome surplus. The Colony now pays on an average £100,000 yearly for imported wood.

II.—CORRESPONDENCE.

Water Areas in Reserved Forest.

DEAR SIR,

When I see legal questions asked in the *Forester*, I have observed that you are glad to have an answer from me, even though the space and time for transit that separate us are so considerable. Moreover, I feel that if others have already sent you an answer, you have always the option of omitting mine; and besides, it may sometimes be useful to have two independent opinions. I proceed therefore to reply to the query in your No. for July 1894, page 259 :—

It will be observed, that the conditions of Indian life, unlike those of Europe, necessitated our opening the Forest Act, with a provision for *constituting* the 'Forests' or areas which were to be subject to Forest Law. In Europe, these areas already were known and existing. Accordingly, the third Section of the Act of 1878 speaks of *land* in which Government has rights, &c., that would hardly justify us in taking up a lake *merely as such*, or an extent of river, or tidal water without reference to the Forest on either side. In the nature of things such a course could hardly be necessary. But if the water were not merely an area of water by itself, but could be regarded as part of an area of land, or as a natural feature of the land, which Government required to treat as forest, then, there is no doubt, that the lake, river, tidal water, &c. included in the boundary, would be part of the forest area, and subject to the Forest Law; if any rights to use water, to fish, etc., were claimed, they would be enquired into and settled under Chap. II* This is obvious from the terms of Sec. 25, which refer to 'fishing,' 'poisoning water' and to rules made on the subject; such a provision could not be effective unless the enclosed river, lake, etc., were part of the forest and subject to the Forest Law.

I do not know what is meant by a "public right of way" to lake B situated in a reserved forest. If there were a public road leading to the lake, it would necessarily imply some right in the public to use the water of the lake in some way, and such a right

---

*** Sec. 10 does not mention rights to 'use water,' but practically such rights (often of great importance) have been held to be included (cf. Sec. 12 Burma Act.)**

should be defined and provided for by the settled arrangements of the Forest. And so, if a private right of way existed to the lake, it would, of necessity, imply that there was some right of using the lake, otherwise why is there a right of way to it?

It will be remembered that Government has a general right to the use and control (for public purposes) of all rivers, streams and lakes and 'natural collections' of water (Act VIII of 1873). This applies to Northern India and the Central Provinces, but there are similar laws elsewhere (see, for example, Bombay Act VII, of 1879, & especially Sec. 37 of the Bombay Land Revenue Code.)

There can be no sort of doubt that a person, who had no right defined and recorded under Chap. II, to use water, or to fish inside a reserved forest and proceeding to do so, would be guilty of a civil trespass, and could be ejected, and further, if having no such right, his fishing, &c., were in contravention of rules (Sec. 25 *i*,) he would be liable to criminal prosecution. Sec 31, (*j*) makes the same principle applicable to the so-called "Protected Forest," only that there is the same doubt about rights that there is in every case owing to the general imperfection of the procedure regarding the class of Forest.

OXFORD, }
August, 1894. }

B. H. B-P.

P. S.—I do not know whether 'fish' are intended to be included in "wild animals" of the definition of "Forest Produce" (*b.* iii), probably they are, but the matter is unimportant, as rules may regulate or prohibit "fishing" in any case.

A Cure for Snake-bite.

SIR,

In the article on "Cure for Snake-bite" in the August issue of the *Indian Forester* there appears to be nothing new in the remedy recommended. The usual method of obtaining ammonia is by treating any ammoniacal salt by a fixed alkali. A sulphate or hydrochlorate of ammonia is generally heated in a retort with lime, ammonia being given off, and sulphate of lime or chloride of calcium being left in the retort. Similar results may be obtained with chloride of ammonium (sal ammoniac) and "chunam." The strength of the solution of ammonia would depend on the operator. The first symptom of ammonia poisoning are irritation and constriction of the throat, which always resulted in Mr. Twining's practice. We may therefore conclude that Mr. Twining's specific was simply a strong solution of ammonia, and that he first recovered the patient from partial or total collapse by the aid of a strong stimulant ; and then, the stomach being able to work, induced vomiting by repeated weaker doses of the same medicine. It is improbable that vomiting would have any beneficial effect on the patient; but served as a visible proof that he had received as much stimulant as he could hold. If the act of vomiting was necessary to the cure, other more powerful nauseates could be used. Probably Mr. Twining would have been more successful if he had stopped short of inducing vomiting, allowing his patient to retain the stimulant. As to the "internal slaking" of quicklime that had already been completed in the retort, that is to say, if quicklime was foolishly used, it would probably be as easy for most people to swallow the cobra as to swallow quicklime, and the ultimate result would be the same in both cases.

O. S.

White-ants and Mr. Cotes' Manual.

DEAR SIR,

I have just come into possession of the Manual of Zoology, prepared by Mr. Cotes for the use of Forest Officers in India. I find Mr. Cotes classes the white ants (*Termitidæ*) and dragonflies (*Libellulidæ*) in the Orthoptera. No doubt he has good reason or good authority for doing so, but to me that given in the Manual, *viz.*, that, like the Orthoptera, they have no pupal stage of rest, seems inadequate. The wing characters, which in these two groups are exactly those of the Neuroptera, seem to me far important.

With your permission, I propose to add here a few remarks on the life history of tha *Termitidæ* to the account of them given by Mr. Cotes, in the hope that I may induce some of your readers to make a study of these curious insects.

It is the general, indeed as far as I know the invariable, rule among the Insecta that a female once fecundated is fertile for life, whether that life be one of hours as with the butterflies, or of years as with the social bees and the ants. Amongst white ants this is not so, the male and female live together as husband and wife all their lives. Mr. Cotes mentions a class of the community, besides the "female or queen," which he calls "winged males 'and females" "which fly out of the nest in clouds, generally after 'rain." The name used is not absolutely scientifically correct, for these are not males and females, but *potential* males and females, in the sense that their sexual organs are not developed. They pair, it is true, but the marriage is not consummated until 10 days or a fortnight later, during which interval the female, always closely followed by the male, has selected and taken possession of the site for the new nest (either in or outside the old nest). This unique (?) system of betrothal is apparently a provision against the chance of adulterous unions (which, as I have shown above, are possible only among the Termites), for the unattached bachelors who formed a large proportion of the original "swarm" have all been cleared off by lizards, birds, &c., long before the date of the actual consummation of marriage between the paired couples. The danger would, however, again arise as soon as new males were born and adopted into the nest with their wives. In a species whose nests I examined in South Africa, I found that the first work of the first generation of workers was to wall up their father and mother in a clay shell rather larger than a walnut, with only one small opening, too small to admit any but a worker. Do the Indian white ants do this, or anything analogous? Every one must have been struck with the parallelism between the social organization of the Termites and the ants, especially in the neuters (?) or workers. But there is a fundamental difference, for among the social bees and wasps and the ants the workers are all aborted females, while the worker white ants are as often aborted males as aborted females. Can this be connected in any way with the half developed males mentioned above? For a thoughtful observer there is a most interesting field of enquiry open among the Termites.

R. C. W.

The strongest timber.

DEAR SIR,

In the *Indian Forester* you ask for information about the iron-wood called 'Bilian' coming from Borneo.

In the Dutch periodical "Natuurkundig Tydschrift van Nederl. Indië," Vol. 25, pp. 1 to 6, the following information is given regarding the *Eusideroxylon Zwageri* by Messrs. Teysmann and Binnendyk. "It is common in Borneo, in the coast regions, 'not in marshy places but rather above the line of the highest 'rise of river inundation. It is known locally by the names 'Belian', 'Blian', 'Boelian', 'Toelian' and 'Oelin.' In Bangka and in Sumatra (Palembang) it is called 'Onglin' or 'Balian.' The wood is as durable as iron, or even perhaps more so. Posts which have for 20 years or more stood the influence of rain and wind, seem now almost as fresh and strong as when the wood was freshly felled. In a short while, Indian Forestry will have some informatiom on the subject, for the Dutch Government has, since May last, had a commission consisting of an Oberförster, two assistants and natives arranging for the exploitation of the 'Onglin' forests of the province of Palembang in Sumatra.

S. H. KOORDERS.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Imperial Forest School Report, 1892-93.

The following is the Resolution of the Government of India on the Forest School Report, 1892-93. We have no information on the subject, but we presume that the Government of India has been trying to persuade the Government of Bombay to utilize the Institution like the Government of Madras. We believe that the Bombay Forest Officers are mostly, if not all, in favour of the arrangement which, of course, could only tend to improve the general *esprit de corps*, and that it is some sort of jealousy which prevents the Governor of Bombay and his advisers from acceding to the wishes of the Government of India :—

" Orders on the Administration Report of the Imperial Forest 'School for the period of fifteen months ending 30th June, 1893, 'were deferred pending consideration of proposals, which have now 'been negatived, for the utilization of the Institution in the scientific 'training of the subordinate forest establishment of the Bombay 'Presidency. During the period under review, a complete set of 'rules for the constitution of, admission to, and discipline at the 'college were issued with the Resolution of this Department 'No. 11-F., dated 28th June, 1893. These rules were prepared by 'the School Board of Control, and submitted at the close of the 'period under notice, during which the school was successfully 'administered under previous regulations and practice. In these 'circumstances the work of the year and the results achieved, 'which reflect credit on the school officers, call for no further 'observations or orders."

Allowances of Working Plans Officers.

The following new rule regarding the grant of allowances to Working Plans Officers has been published :—

" The Local Government may, when a working-plan has been 'approved and accepted, sanction to any officer who may have 'been in charge of such plan, a remuneration which shall not 'exceed Rs. 100 per mensem for the time during which he has 'been at work on such plan ; provided that no remuneration 'shall be granted unless the Local Government is satisfied that the 'officer has undergone exceptional exposure or incurred exceptional expense. This rule shall apply to both specially appointed Working-Plans Officers and Divisional Forest Officers in 'charge of working-plans.

" The rate of remuneration shall be fixed with regard to 'the importance and character of each plan, the labour and exposure entailed in its preparation, and the proportion of the 'officer's time occupied in its elaboration. The limit of Rs. 100 'per mensem shall not be exceeded in consequence of an officer 'being employed on two or more plans at the same time.

' When two or more officers have been in charge of the same 'plan or plans, the remuneration granted should be divided in 'proportion to the time that each officer was in charge, subject to 'the consideration of the quality of the work and the labour 'entailed in each case."

IV.—REVIEWS.

Annual Forest Administration Reports, for 1892-93, for Bombay and Burma.

The chief event of the year in Bombay was the formation of a new Circle by sub-dividing the old Northern Circle, so that there are now four Circles in Bombay: Northern, Central, Southern and Sind. To the great disappointment, however, of Bombay officers, there is a decrease rather than an increase in Conservatorships, for two of the appointments, at present, the Northern and Sind, are to be held only by Senior Deputy Conservators. To have started a sense of disappointment and injustice for the sake of Rs. 400 a month was hardly worth while, for the money might easily have been saved in some other way.

The Circles as now divided comprise the following districts—

N. Circle—Thana, Surat and Panch Mahals.
C. „ Khandesh, Nasik, Ahmednagar, Poona, Satara, Sholapur.
S. „ Kanara, Belgaum, Dharwar, Bijapur, Kolaba, Ratnagiri.

So that it would seem that the contention of the Southern Circle Conservator that the two Concan districts of his charge ought to be transferred to the Northern Circle, or the whole arrangement altered, has reason for support.

Mr. Dasai's report on the new Northern Circle is an interesting one, and contains many points worthy of note, and among them the following remarks by the Collector of Thana regarding the high percentage of acquittals in his District:—

"I review nearly all forest convictions myself, and I think 'the falling off in percentage of convictions to be rather due to 'greater care on the part of the Magistrates (formerly very lax in 'matter of evidence in forest cases) and to the personal equation 'of one or two Magistrates than to any difference in the departmental methods of prosecutions."

We wonder if he took any steps to make the latter set of Magistrates understand that justice, and not personal bias, was what was required when cases had to be tried, forest or any; and whether he had any idea how extremely difficult it is for a Forest officer to obtain full evidence, even in cases where there can be no practical doubt of the matter.

In the Central Circle Report, too, there are some remarks on the question of forest prosecutions, which are of interest:—

"The cases prosecuted in the course of the first twelve months 'of the forest year in the Satara Division exceeded by 87, the 'number of the year before, and the percentage of failures shows a 'slight increase. The Divisional Forest Officer complains that 'some of the Subordinate Magistrates deal out very lenient law to 'the offenders, and dismiss them on the grounds that "the offences 'were not intentionally committed, and the accused had no intention of setting the forest on fire when he was smoking in the 'forest, and therefore is not guilty;" and in cases in which men 'of position, such as patils, &c., are accused, they are dismissed, on 'the plea that they are not the sort of men to trespass cattle. It 'is no wonder, then, that cases which are fully scrutinized by the 'Divisional Forest Officer before they are sent for trial, should go 'to increase the percentage of failures, for the Forest Act does not 'recognize intention, and the Divisional Forest Officer in his 'treatment af forest offences is guided by the Forest Act, while 'the Subordinate Magistrates ignore the forest law on the point, 'and require "intention" to be proved."

Again, in Sind, the question of prosecutions is discussed, and an example is given where a Divisional Officer, who seems to have taken too literally the remarks made last year by the Commissioner, got duly snubbed for his pains:—

"The Deputy Conservator regrets to report that the remarks 'made by the Commissioner in Sind in para. 6 of his review of 'last year's report have been misunderstood, and have caused Divisional Forest Officers to refrain from instituting proceedings, 'where proceedings were necessary. In one instance a Divisional 'Forest Officer refused to prosecute in a case, and when called 'upon for an explanation, wrote: "I have no desire to be harsh 'in administrating the law, and I hoped it would be understood 'that, in declining to prosecute in the case under reference, I was 'endeavouring to carry out the Commissisoner's wishes." This, of 'course, could not be allowed, and the Deputy Conservator was compelled to write to the Divisional Forest Officer as follows: "I am 'afraid you are allowing the Commissioner's remarks in para. 6 'of his review of the last Administration Report to influence you 'more than they are intended to do as regards the prosecution for 'forest offences in your Division The Commissioner never intended that serious forest offences should remain unpunished. 'He simply wished to caution forest officers against any undue 'severity, and to impress upon them the necessity of acting in a 'kindly and forbearing spirit to those living on the borders of the 'forests—nothing more. It is scarcely necessary for me to point 'out to you that should it become known that you decline to take 'action against offenders, offences will increase to the detriment of 'the forest, and the demoralisation of those serving under you. 'The disinclination you appear to manifest to support those of your 'subordinates who have actually been assaulted, will have a tendency either to prevent them, through fear, from doing their duty, 'or it will cause them to combine with the people and take com'pensation from offenders for their own benefit. In the case 'referred to in the letter under reply you are requested to pro'secute the offenders."

It is satisfactory to read the remarks of the Government on this subject, for they lay down their policy in a dignified and satisfactory manner:—

"The percentage of failures is higher in all the Circles than 'in the preceding year, and notably so in the case of the Nor'thern Circle and Sind. The reasons given for this result are 'various. Different Magistrates hold different views as to the 'gravity of offences against Forest law, and as to the nature and 'amount of evidence sufficient to justify convictions in such cases. 'The result may be due, as Mr. Sinclair surmises in the case of 'Thana, to greater care on the part of Magistrates in weighing 'evidence rather than to any difference in departmental methods 'of proceedure. There appears, however, to be on the whole a 'prevailing disposition on the part of the Magistracy to treat for'est offences leniently. It is the policy of Government to prevent 'forest restrictions from becoming harassing so far as is possible 'with due regard to the paramount importance of preserving the 'sources of supply. Leniency in dealing with breaches of For'est law is proper in the case of first offences and petty and isolat'ed pilfering for personal use. It may also be proper when restric'tions necessitating sudden changes in the daily habits of the 'people have been recently introduced, and are imperfectly un'derstood. But leniency is misplaced and destroys the deter'rent effect of criminal prosecutions when forest depredations, 'however trivial they may appear when considered as individual 'isolated acts, have become in any locality, in spite of repeated 'warnings, systematic and persistent."

Some of Mr. Dasai's remarks on natural reproduction are worth quoting especially those which relate to the result of the coppice cutting:—

"In the Thana forests natural reproduction was vigorous 'during the year and would be perfect if fires and cattle trespass 'could be wholly checked. The coppice in most of the exploited 'coupes grows fast, though the teak excels other species in this 'respect during the first years of its re-growth. The shoots also 'suffer to certain extent, when they first commence to appear, 'from the browsing of wild animals, such as nilgai and four-horned 'antelope; the neighbourhood of a recently felled coupe being al'most a certain find for one or other of these animals. In a good 'many of the compartments exploited in the earlier years of the 'Working Plan rotation, *i. e.*, in 1887-88, a dense crop of promis'ing mixed forest is now to be seen, and the progress made by 'each year of successful closure in dominating the grass, reeds 'and other noxious growth has secured the compartments from all 'possible danger from fires. So long as there is a sufficient area 'open to grazing for the wants of the people, it is not advisable to 'shorten the limit of closure of ten years fixed in the Working 'Plan, for the longer the young stock is left undisturbed the better 'it will grow."

In other Divisions, fires have prevented natural reproduction to a considerable extent, but the following testimony of Mr. Lely, Collecter of Surat, to the labours of the Department will be read with interest:—

"Some of the forests in the south of the district though small 'are pictures. In Mandvi Taluka the soil is inferior, but the De-'partment is there reclothing large tracts of land and vindicating 'itself as one of the most useful agencies of the country."

In the Central Circle report, too, there are some interesting remarks on natural reproduction :—

"The year under report was favourable to natural reproduc-'tion, owing to a plentiful and seasonable rainfall generally 'throughout the Central Circle. In the East Khandesh Division 'it was very refreshing to observe the myriads of young plants of 'teak and of other kinds of timber trees resulting from self-sown 'seeds which appeared in suitable soil, on the bank of the Aner 'river, and in fire-protected areas, in the Satpuda and other for-'ests. The Anjan (*Hardwickia binata*), which does not seed an-'nually or regularly, seeded during the year, and has given an 'abundant supply of young life in the Transpurna, the Raver, 'Savda, Yaval and other reserved forests where this valuable tree 'predominates. The stools of trees which were felled in the for-'ests of the Jamner Range and in the Satpudas have thrown up 'vigorous shoots with scarcely any failures."

There is nothing particular to be noted, on this subject, in the Southern Circle Report, but the Sind officers complain that the river bunds are seriously affecting reproduction. Mr. Hexton says :—

"There can be no doubt that the bunds prevent a vast amount 'of natural reproduction, and have rendered many of the once 'well-wooded areas quite useless for forest purposes. Take the 'country from Kashmor to Shewan on the right bank of the river, 'nearly the whole of this portion of Sind is cut off from the floods, 'the result being that the jungles are fast drying up, and unless 'some change takes place, there will soon be a scarcity of fuel even 'for domestic purposes."

The following remarks from the Northern Circle Report are interesting, as drawing attention to a minor produce industry, of which little is known outside Bombay:—

"Of the two trees, 'apta' (*Bauhinia racemosa*) and 'temb-'burni' (*Diospyros melanoxylon*), whose leaves are used as 'wrappers for cigarettes by the people generally, the latter has 'been so much damaged in the past during the process of plucking 'that it was considered desirable to put a stop altogether to the 'farming of its leaves, and in order to further improve its growth, 'mutilated specimens to be met within the coupes are no longer 'to be reserved as standards, as was the practice in former years, 'for the sake of its fruit. The tembhurni coppices fairly, and if 'the injured and deformed trees are properly cut and trimmed, 'and the leaves protected, it ought to yield good timber when it 'reaches the exploitable age. The main utility of the apta trees 'lies in its leaf, it being not valuable as timber. It is also very 'hardy, stands a good deal of knocking about, and does not suffer 'to the same extent as the tembhurni from harmful treatment 'The demand for its leaves is already fairly large, and there is a 'prospect of its increasing in proportion to the diminished supply 'of tembhurni leaves, and, therefore, its exploitation has to be 'restricted."

We are rather doubtful as regards the policy of trying to grow ebony wood rather than to exploit the same for the local uses of its leaves. The best Indian ebony is that of the South Indian *Diospyros Ebenum*, a tree which is by no means common even in the dry Carnatic evergreen forests which it affects, and the wood of *Diospyros Melanoxylon* and *tomentosa*, the common ebony trees of South and North India, respectively, gives so little real ebony, even when the trees are large and sound, that it may be doubted whether it is worth while to try and encourage them for the growth of the fancy wood. It might, perhaps, be better policy to reserve both 'apta' and 'tembhurni' among the coppice standards in order to allow of their being pollarded yearly for their leaves. This subject further suggests to us the question whence comes the ebony which is quoted in the English market as 'East Indian'' There is not much of it produced, and sold in the Madras Presidency, perhaps the bulk comes after all from the Bombay coast forests!

Artificial reproduction works for the filling of blanks in the forests seem to be much more successful in Bombay than in other provincess. In the Northern Circle 3,640 maunds of seed were sown by Forest Guards in one Division alone, and very extensive works seem to have been carried out in the Central Circle. On the works done by forest guards, Mr. Shuttleworth says :—

"The cultural operations undertaken by forest guards, as a 'part of their ordinary duties. cannot but have a marked effect 'upon the re-wooding of the country within the Central Circle. 'Each forest beat, (and all the forest areas in every division are 'divided into beats, so that not an acre in charge of the Forest 'Department is left outside a beat), is an unit of plantation ; so 'that reboisement is pushed on yearly in as many different localities 'spread over the face of the country, as there are forest guards in 'charge of forest-beats."

And we can only feel envious, as we said last year (Vol. XIX, p. 393), for our own experience of forest guards in several provinces is that not only do they not attend to such work, but that they *could* not consistent with the protection and supervision of an unwieldy area. We hope the day may soon come when the increasing yield of the forests will make it possible to reduce the size of beats, so that each guard will have scarcely more to look after than has a French 'Garde forestier,' and like him can do most of the planting, cleaning and similar work in his charge. The returns in form 56 for the four Circles give the following work done, taking additions only :—

	REGULAR PLANTATIONS.		CULTURAL WORKS.	
	Area	Cost	Area	Cost
	A.	Rs.	A.	Rs.
Northern ...	438	807	2,851	1,747
Central ...	2,144	4,383	95,427	9,827
Southern ...	41	848	10	557
Sind ..	...	2,155	6,505	...
	2,623	8,193	104,793	12,131

though we do out pretend to understand the figures.

The Review of the Forest Reports by the Bombay Government is noticeable for its much more conciliatory tone than usual, and for the way in which it gives full credit to the Conservators for their work during the year. We have not received the review of the Government of India, so we will conclude with the following extract from the 'Pioneer' of September 13th regarding it :—

"Remembering the friction that once existed in the Bombay 'Presidency between the Forest officers and the Executive, the 'comments of the Government of India on the local Forest Admin-'istration Report for 1892-93 are pleasant reading. The able and 'exhaustive review of the Governor in Council is acknowledged, 'and it is added that "the harmony and good feeling which mark 'the relations between Revenue and Forest officers, and the praise 'bestowed by His Excellency on officers in charge of forest circles, 'for the efficient manner in which they have discharged their 'duties, and on Revenue officers for the cordial assistance they 'have rendered, have been noted with satisfaction." We need not 'comment on this, beyond expressing the hope that the harmony 'thus established may endure, and that there is nothing behind 'the scenes likely to disturb it. As to the report itself, the figures 'show that only a small increase of Rs. 18,000 occurred in the net 'revenue from forests as compared with that of the previous year ;

"but the surplus was nearly Rs. 95,000 above that of the quinquennial average. Bombay gets now about 13¾ lakhs clear profit from its forests, and this sum is capable of expansion. A difficulty has arisen in Sind, where the growing demand for fuel has been checked by the restriction of the productive forest area owing to the exclusion of flood-water from the Indus. The Government of India consider this a grave question, but note with approval that the difficulty is being met by the constitution of reserves in alluvial lands outside the influence of protective dams. Even this, however, may not prove sufficient, and it is suggested that irrigated plantations may be found to be necessary. The subject is one in which experts should be consulted without delay."

In reviewing the BURMA Reports, the Government of India say :—

"The chief administrative measures involving change were the division of Upper Burma into two circles; the promulgation of a revised edition of rules under the Upper Burma Forest Regulation, and their extension to parts of the country which had till then been exempted; the enhancement of the royalty on timber extracted for trade purposes in the upper portion of the province; and the inclusion of *kaungmhoo* (*Shorea stellata*) in the list of reserved trees."

And they comment on the financial results as being the best on record. These were, for the whole Province :—

		Rs.		
Revenue	Financial year	56,60,001	Forest year	54,73,058
Expenditure	„ „	17,47,356	„ „	18,18,480
Surplus	„ „	39,12,645	„ „	36,54,578

showing what a valuable property the Burma forests are to the State.

The Local Government's Review give us the statistics of export of teak from Rangoon and Moulmein during the last 5 years in the following table :—

	FROM MOULMEIN.		FROM RANGOON		TOTAL.		
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Average value per ton.
		Rs.		Rs.		Rs.	Rs.
1888-89 ...	93,465	77,21,819	62,969	48,99,547	156,434	1,26,21,366	80·7
1889-90 ...	80,871	70,05,857	103,560	81,84,843	184,431	1,57,90,700	82·4
1890-91 ...	64,227	47,01,434	110,888	78,75,794	175,115	1,25,77,228	71·8
1891-92 ...	62,320	41,88,267	99,647	75,13,397	161,967	1,17,01,664	72·2
1892-93 ..	106,850	72,57,412	109,336	91,85,043	216,186	1,64,42,455	76·06

The Tenasserim Report begins with an account of the Circle, which we think quite worthy of reproduction as a short and concise piece of information. After noting that the Circle covers about 35,308 square miles, of which 941, square miles may be roughly reckoned as cultivated land; that there are 4 forest Divisions; and that there are 1,877 square miles of reserved forest with 148 square miles of fire-traced area, and 9,389 acres of regular and taungya teak plantations, he goes on:—

"The teak forests which form the most valueable portion of
'the State forest property lie all in the northern half of the circle.

'Teak, so far as has been observed, does not in Tenasserim
'extend much below the latitude of Yè, 15° 5'N; such stragglers
'of the species as are found further south being of poor growth,
'sickly, and ill-formed.

'In past years the teak forests on the Thaungyin, Salween,
'and Yunzalin rivers, and more especially those in the valley of
'the Ataran, were the sources from which the supplies of the
'famous "Moulmein teak" were drawn. But for years past the
'yield has deteriorated both in quantity and immeasurably in
'quality, the forests having been ruthlessly worked mostly under
'the pernicious lease system, which still lingers in the five unex-
'pired leases now running in the Ataran valley.

'Besides teak, several other valuable woods, padauk (*pterocar-
'pus*), kanyin (*Dipterocarpus lævis*), thingan (*Hopea odorata*),
'kaunghmu (*Shorea stellata*), pyinma (*Lagerstrœmia*), pyinkado
'(*Xylia dolabriformis*), &c., are to be found in more or less
'abundance in Tenasserim, more specially in the southern forests,
'and until the teak forests under the State management and care
'now given to them shall have recuperated themselves, the forest
'outturn and revenue must, in the near future, depend largely on
'the introduction into the market of woods other than teak.

'One of the great wants in the circle is the want of good
'communications in the interior. Practically speaking the rivers
'(many of which including the chief river, the Salween, are
'blocked by rapids) are the chief means of communication. Roads
'are few and far between; the extent of the roads made by the
'Public Works Department of the State is as yet small; and the
'country roads are mere jungle tracks leading from village to
'village, and liable to alteration, and even complete obliteration
'on the removal of a village-site.

'It is this want of easy rapid communication that makes the
'forest administration of the circle difficult, and retards in many
'ways the introduction of a more thorough supervision and
'management of the forests."

This account of the Circle shows that it is by no means an easy one to manage, and that good communications and commercial enterprise are required to bring into the market the splendid timbers other than teak, of which there seem to be such a magnificent supply. Here seems to be the field for the development of the wood-paving trade which assuredly we, in India, have not done near enough to take advantage of. To an outsider, it would almost seem that the wants of the Circle in the way of communications might be met, at any rate on these rivers where there are good stores of suitable timber, by improvement of the navigation of the rapids by means of small locks and canals in some places, and in others by portages with short lengths of portable tramway. That a market ought to be got and can be got by perseverance for such timbers as 'padouk' and 'pyinkado' we feel quite sure, but rates will have to be cheap and profits small at first, for there are few things so difficult as to get new products into the market and to get new timbers into regular trade.

Major Bingham's remarks on a curious fact in regard to the natural reproduction of teak are worth quoting. He says:—

"As bearing on the natural reproduction of teak it is a noteworthy fact that there are many localities in Tenasserim where 'for some unknown reason teak seed rarely matures, and seed 'locally collected for sowing in taungya teak plantations is very 'often entirely worthless. For the last two years the supply of 'seed for taungya teak cultivation in this circle has been imported 'largely from the Pegu circle, and contrary to what was anticipated the results are far better than can be obtained with locally 'collected seed."

Taungya teak cultivation in Tenasserim seems to cost about Rs. 6-8 per acre, and in Pegu about Rs. 8-8 per acre.

The Pegu Circle extends over an area of 38,020 square miles of which 4,180 are under cultivation and 3,912 are Reserved Forest. There are seven Forest Divisions with a Working Plan Division and an Agency Division.

Mr. Carter's account of natural reproduction in the drier forests where bamboo abounds are interesting :—

"In the drier forests where the prevalent bamboo is myinwa '(*Dendrocalamus strictus*) which flowers in patches almost every 'year, the natural reproduction of teak and other species is fairly 'good, and in such forests fire-protection not only improves the 'forest growth generally, but furthers the natural reproduction of 'teak. In the moister forests where the prevalent bamboos are 'tinwa (*Cephalostachyum pergracile*), and kyathaung (*Bambusa 'polymorpha*) which do not flower spasmodically, natural production is confined to gaps in the bamboo canopy which are not of 'frequent occurrence. In this forest fire-protection improves the 'general forest growth, and has a marked effect on the distribution 'of the water-supply, but it is not favourable to the natural reproduction of teak. The probable effect of continued fire-protection 'would be to increase the area of evergreen forest in which teak 'would not find a place if the forester trusted to natural reproduction alone.

'In the Kôn-Bilin forest we have a considerable area on which 'the tinwa flowered six years ago. A part of this area is protect-'ed from fire, and inside the fire-trace not a single seedling of any 'other species than bamboo can be found, while outside the fire-'trace such seedlings are very few and far between. In the Pada 'forests of the Shwegyin division, in the area on which the tinwa 'flowered at the same time as in the Kôn-Bilin, a fairly good 'natural roproduction of teak has been noticed. More recently, in '1891, the kyathaung bamboo flowered over a large area of the 'Western division. The Divisional Officer states that the young 'growth of bamboo is 3 feet high, and is silent as regards seedlings 'other than bamboo. In the Toungoo division there is a fair 'reproduction of cutch over a limited area from which the mature 'cutch trees were removed four years ago."

There is scarcely any question of sylviculture in India or Burma so difficult as that of the reproduction of timber trees in bamboo areas, whether it be of teak in Burma or of Sál and other valuable trees in Bengal and elsewhere. The following remarks of the Pegu Conservator on the subject of the Europe market for teak deserve reproduction.

"The course of the Europe markets has been one of disap-'pointment to shippers during the period under review. Prices 'which ruled at about £10-10 to £11 in the early months of '1892, declined to £9 to £10. The demand for teak for ship-'building and for railway carriage construction was contracted. 'Planks were sold at from £9 to £10-10 The continental demand 'for teak has again increased, being fully 33 per cent. of the 'shipments to Europe as compared with 25 per cent. in the pre-'vious year. France bought largely for naval purposes, and there 'was the usual demand for Germany, Italy, Holland, Belgium, 'and Spain. There was no increase in the quantity of teak 'shipped to Europe from Siam, although the floating season 1892-'93 was a favourable one, and fully 70,000 logs reached Bangkok 'during the year.

'The advance recorded in the last report was not of long 'duration, and timber not moving off freely in the selling markets, 'prices have declined again to about Rs. 65 to Rs. 70 for selected 'Indian squares and Rs. 55 to Rs. 60 for an inferior class of 'timber."

The Upper Burma forests were, during 1892-93, divided into two Circles, Eastern and Western; the former containing at the close of the year 1,447 square miles and the latter, 822 square miles of Reserved Forest, with large areas of Protected Forest in addition.

One of the most interesting matters treated in the Eastern Circle Report is that of the difficulty of preventing illicit cutch boiling. Mr. Oliver says, in regard to this :—

"Sixty-nine cases were in connection with illicit cutch boil-'ing and of these 49 out of the 54 that were taken into court re-'sulted in convictions. The protection afforded to cutch during the 'year has been altogether inadequate. At the beginning of the 'season, in order to prevent the forests from being overworked, 'the issue of licenses was restricted to a limited number of cauldrons 'fixed for each district approximately in accordance with its cap-'abilities. This led interested persons to investigate the law in 'the matter, and it soon became generally known that the Forest 'Department had no power to protect trees on land not at the dis-'posal of Government. Owing to the growing scarcity of wood 'for boiling, the demand increased considerably, and people who had 'not sufficent cutch to make it worth while to boil it themselves, 'found a ready market at Rs. 3 per cart-load for the trees growing 'round their fields; not only have trees of all sizes been felled, 'but the stumps and roots have also been extracted, thus reducing 'the possibility of reproduction to a minimum. Cutch is conse-'quently being fast exterminated in private lands. A further 'result of a better understanding of the Forest Regulations has 'been the manufacture in considerable quantities for the adultera-'tion of cutch of *thansha* (decoction of *Terminalia Oliveri*) from 'trees grown on private lands."

"The destruction of cutch trees would not have mattered so 'much if it had been confined to *bonâ fide* private property, but in 'many places, particularly in the Meiktila, Yamethin, and Shwebo 'districts, persons claimed as private property all land that had at 'any time been cultivated permanently or temporarily either by 'themselves or their ancestors together with the adjacent forest 'and proceeded to boil cutch on it. Land of this class includes 'practically the whole of the cutch forests in these districts. Some 'of it is no doubt private property, but to the greater part the 'claimants can prove no legal title. The Forest Department has, 'however, before it can interfere, to show in each case that the 'land is not private property, and it will be easily understood that 'with the weak staff available it has not been possible to cope with 'the difficulty, especially as in the cases that were successfully 'prosecuted. the small fines inflicted (which ranged from Re. 1 to 'Rs 30) have had no deterrent effect. Reservation of cutch tracts 'will no doubt be the best remedy for the present state of things, 'but until the controlling staff is strengthened progress in this 'direction must be slow."

And there are very similar remarks to be found in Mr. Home's report on the Western Circle.

On the subject of natural reproduction, the Western Circle report has some interesting information which we reproduce.

"The general purport of Divisional Officers' notes on this 'subject is that reproduction of teak, cutch, and pyinkado (*Xylia 'dolabriformis*) is naturally good, but that annual fires do not often allow the seedlings to survive over one season. This is only 'as must be expected, and until fire-protection is systematically 'carried out no practical improvement in this respect can be 'hoped for.

"The wabo (*Dendrocalamus Hamiltonii*) is reported to have 'flowered over extensive areas in the Nantainkwin forests in the 'Upper Chindwin, but it is too soon to judge with what effect as 'regards the reproduction of teak. The myinwa (*Dendrocalamus 'strictus*) was noticed to have flowered over considerable areas in 'the Upper Myittha near Anyaban and in the Sanni drainage; 'these areas, which were visited by the Conservator, were found 'to be one mass of fine Cutch seedlings, which will be destroyed almost entirely next season by fire; this bamboo has hitherto been 'observed to flower over small areas only annually, but the flowering over the localities named was more general than usual. The 'pyinkado flowered very freely in the Upper Chindwin.

We have read all four reports with great interest, and have endeavoured to select for reproduction the most interesting points, but there are many other matters of importance and interest, and for these we can only refer our readers to the Reports themselves.

Annual Administration Report of the Agricultural Department, Central Provinces, for 1892-93.

The only matters in this Report which are connected with the Forest Department are the references to 'Fodder Reserves' contained in paras. 18—19, which we reproduce as being the sort of thing which leads to unpleasantnesses and difficulties between Departments.

Para. 18 shows us that something in the nature of an 'opposition shop' is being started in the Central Provinces, that the Director of Agriculture is not satisfied with the ordinary professional agency, and that he is starting reserves of his own, and is going in for "strict conservation" with no "desire to gain an income for Government." It is just possible that the financial authorities of Government may not look upon this generosity in quite the same light: with the rupee at only a little over a shilling, deficits to be met, economies in every branch of the administration to be carried out, and taxation of the least unpleasant kind to be provided, it is not improbable that Mr. Fuller's philanthropy may not be quite so acceptable as he seems to think it will be. His little reflection on the income-gaining propensities of forest officers is not worthy of the pen of a Head of Department.

We have to work, practically and financially, on the lines which Government lays down. It cannot say to us, however, "we expect so many lakhs of rupees surplus revenue, but you must not charge for forest produce." As forest officers only, it is all one to us if the Government gives away *all* its produce *gratis*, provided that it does not make us accept the responsibility for doing so, and provided that we are permitted to manage the forest estates with a due regard to the maintenance and improvement of the capital. We are the servants of Government just like Mr. Fuller, and the Chief Commissioner has as fully the authority to regulate the proceedings of the forest officers, as he has over agricultural experiments. The narrow-minded view of the object of the Forest Department taken in para. 19 is, however, not likely to commend itself to any statesman, who can understand that the Department has other clients than agriculture ; and that there could not be a worse policy than to manage it solely in the interest of one. We quite think that the authorities should (and probably do) consult the Director of Agriculture on questions relating to the Department, just as they would consult the Chief Engineer on matters where Public Works interests were concerned, or the Accountant General on questions of finance. What we want to see and what we are sure that our Government, Imperial or Local, really desires, is a complete '*entente cordiale*' between all its officers, of whatever Department they may be; and we think it a great pity that such statements as those we quote should find place in a Government Report :—

"The acquisition has been completed of eleven plots of unculturable land in the densely populated area of the Raipur and Bilaspur districts, to be managed as Fodder Reserves in the interests of the people. In regard to the Fuel and Fodder Reserves which were established in the Sambalpur district at its recent re-settlement the Deputy Commissioner writes that they are managed in the Revenue Department by Patwaris and Inspectors, and are improving in condition. Stricter conservation is to be enforced, but I trust that it will not be influenced by any desire to gain an income for Government.

'Experiments undertaken in this Department on the barren range of trap hills near Nagpur to ascertain whether jungle growth could be assisted by sowing seed, have so far resulted in failure, but will be continued during the present year on rather different lines.

"The term "Fuel and Fodder Reserves" customarily refers 'only to a few small plots of land which have been specially taken 'up during the past six years, but as a matter of fact the greater 'portion of the Government Forest Reserves—covering nearly '20,000 square miles of country—is of practical value as subsidiary 'to agriculture and not as a source of commercial products. The 'sale of timber constitutes indeed quite a minor item in the re-'venue of the Forest Department, which represents in great part 'money paid by the agricultural population for services or supplies 'connected with their cultivation. My long acquaintance with the 'rural circumstances of the Provinces may perhaps be held to justify 'the expression of my opinion that the management of the Forest 'Department too often ignores the essential connection between 'its lands and those under cultivation, and follows lines which, 'however efficacious in producing revenue, are calculated to cramp, 'not to develop, the agricultural resources of these Provinces. 'It would be out of place here to instance in detail cases with which 'I have to support this view. The question is one with which I 'have had no official connection, and the representations on parti-'cular cases of hardship which I have from time to time submitted 'to the Forest Department have naturally suffered from the ap-'pearance of gratuitous criticism. I trust that I may be pardoned 'for venturing to record here that, in my judgment, more is re-'quired to ensure that questions of Forest management and Forest 'rates which are connected with the practices and requirements 'of the agricultural population, are not decided without full and 'careful consideration on the agricultural side, and that the Direc-'tor of Agriculture should be formally authorized to institute pro-'ceedings for the modification of arrangements which are prejudi-'cial to agricultural development, and should be given a voice in 'the introduction of changes, whether of system or rates, which 'will affect the circumstances of the agricultural population."

Administration Reports of the Madras Government Museum and Nilgiri Parks and Gardens, for 1893-94·

The first of these reports is an interesting and well-written one, evidently written by the Superintendent himself, and not merely compiled in conventional style by the office clerks. It is probable that the Madras Museum is the best managed institution of the kind in India; it is somewhat crowded, but is bright and pleasant, and in that way contrasts very favourably with the rather dreary galleries at Calcutta. But in the Report there is, naturally, not much to interest us professionally, except that the Economic Museum includes forest products, and has made a good beginning. The Nilgiri Botanical Gardens' report is also interesting, and there are notes on some forest products, which are of interest. The following regarding the *Cassia auriculata* shrub shows that the Superintendent has not heard of its having been cultivated successfully in the plantations on poor laterite soil near Rajampet in the Cuddapah District:—

"*Cassia auriculata.*—Messrs. Cooper, Allen and Co., of 'Cawnpore, asked for information respecting the cultivation of the '*Cassia auriculata*, and were told that, so far as was known in this 'department, the plant was never cultivated, but was obtained as a 'minor forest product; but that if they wished to cultivate it, it 'was believed that it would not need irrigation, as in a wild state 'it grows in hot dry places. It was also pointed out to Messrs. 'Cooper, Allen and Co. that if they undertook its cultivation, they 'should allow it to grow for several years before barking the 'shrubs; as Mr. Hooper's analyses had conclusively proved that 'the bark taken from old stems was many times richer in tanning 'than that taken from young stems or branches."

It is not very easy to start, but we believe that when once started it might be cultivated as a crop quite easily, though perhaps the winter at Cawnpore might prove a little too cold for it. We would recommend trying it sown broadcost on well ploughed land, the seed having been previously well-soaked to assist germination.

It is reported that blue-gum oil is now regularly prepared by private firms who sell it wholesale at from Rs. 2-4 to 2-8 per ℔.

The *Ceara* and *Castilloa* rubber trees at Barliyar were again tapped, but with very poor results, though what was obtained proved to be of very good quality.

VI.—EXTRACTS, NOTES AND QUERIES

The New System of Coupes in the C. P.

We have received from Mr. G. F. Taylor a photograph showing one of the new coupes with the standards left as reserves. The picture gives a good idea of the style of the operations which have recently been started, and which will do much to improve the forests as well as to provide material for the use of the country. The number of standards left is 60, and the photograph shews these with a broad mark of white paint around them. Our acknowledgments are due to Mr. Taylor for his interesting communication.

Seeding of Forest Trees.

Pterocarpus Marsupium is reported to be seeding well all over the Palni Hills, Madura District, Madras, this year. The seed is now well developed, and promises a good crop in October and November.

Bamboo Seeding in Bengal.

Mr. F. Trafford, Assistant Conservator of Forests, Tista Division, Bengal, writes to say that the 'Tama' bamboo (*Dendrocalamus Hamiltonii*) is flowering abundantly this year, and that large quantities of the seed can be collected, if required.

Foresters as Cyclists in France.

We notice in a recent number of *Revue des Eaux et Forêts* that a circular has been issued to all Conservators of Forests in France from head-quarters, informing them that in future Forest Officers up to and including 'Inspecteurs' are to be exempt from the velocipede tax imposed by the law of 28th April 1893. The Resolution requires that Conservators should satisfy themselves that the concession is not abused, and to this effect it has to be certified that the possessor of the velocipede uses it in the public service.

It is stated that experience has shown how extremely useful these machines are to members of the Forest Service by whom they are very largely used. That this would appear to be the case is also indicated by an article of the Resolution, which provides for the exemption of departmental velocipedes also when in use by members of the department.

It is not stated whether the term velocipede includes the tricycle or not; we trust it does, as this will 'no doubt' be a matter of interest to some of the less active members of the department.

The Restoration of Scenery.

The preservation of scenery, by making "natural pictures" a kind of public property, to be preserved and kept for the æsthetic enjoyment of the people, just as paintings are purchased and preserved for the same purpose, has more than once been advocated in the *Spectator*. Professor W. R. Fisher, in communicating to the *Daily Chronicle* some observations made in the industrial districts of the Belgian Ardennes, and subsequently in the Black Country of our Midlands, "goes one better." He sees his way to a plan for the restoration of scenery ; and unlike the restorers of "genuine old masters," who made a mystery of their doubtful craft, he gives full details of his experience in both countries, and his conclusions as to the treatment necessary. It was when staying at Château Mirwart, in Belgium, that he first conceived the idea of "restoring" the Black Country. He saw vigorous ash and sycamore trees growing on heaps of glassy slag from an abandoned iron-furnace. That kind of slag is almost the least promising material for woodland soil which can be imagined. It is hard as glass, breaks into shiny lumps, like the "rock" sold on sweetstuff-stalls in the streets, and has very seldom been put to any useful purpose. At Middlesbrough, where, on the shallow, muddy, dull banks of the Tees estuary, there was never any "scenery" worth looking at at all—the Black Country of Cleveland is hardly less picturesque than the sour flat fields which once fringed the the ugly estuary—they "dumped" hundreds of thousand of tons of slag along the banks, and gained a deeper river and a firm bank and quay. But it does not grow trees yet. Probably it never will. But as the trees grew in the slag, or among the slag, in the Ardennes, the idea occurred to Professor Fisher that the great "spoil banks," or heaps of all sorts of soil dug out of the pits before the coal or iron is reached, might just as well be planted with trees in England. If they were set with the quickly growing kinds used for mine props, the enterprise might be profitable as well as picturesque. The soil in these mounds is by no means of the forbidding character which appears on the surface. The deeper the mine, the more rocky, as a rule, is the debris extracted ; but this, which is taken out last, and scattered on the surface, often conceals thousands of tons of good soil piled below. There is, therefore, no reason why the colliery and ironstone countries should not be covered with wooded mounds, wherever a worked-out or disused pit now marks the surface with an ugly and disfiguring scar. Scotch fir, a rapid-growing, hardy, and self-sowing species, is clearly the tree for the purpose. Moreover, it is in great demand for prop timber, and the estimate of 70,000 tons imported for that purpose quoted by Professor Fisher, is probably far below the mark. Some such effort at restoration of ruined scenery seems to be entertained in a different quarter. From the Welsh coal-districts there comes a separate and independent demand for "afforesting," partly with a view to a supply of mine-timber. Mr. Lloyd-George and other Welsh members drew attention in the discussion on Supply to the need of replanting Crown lands in Wales with timber, the present destruction of which made it necessary to buy mining-props in France. Sir John Hibbert was able to reply that their wishes had the sympathy of a Commissioner of Woods and Forests, who was then engaged in a tour, in order to discover how far the project could be made to pay, and whether the local feeling was in favour of planting. In the true Black Country, Professor Fisher found conditions somewhat different from those generally seen in a country whose amenity has been destroyed by manufacture. The cause of the early destruction of the scenery, and the early wealth of the Black Country, was the wonderful coal seam, which ran beneath it, and its nearness to the surface. In one of the largest mining enterprises of the last few years shafts of twelve hundred yards deep were sunk to reach the Barnsley seam of 9½ ft. thick. In 1850 a seam *thirty feet thick* ran so close beneath the surface in parts of Staffordshire and Worcestershire that, according to Professor Fisher, nearly every one who had land above it dug an independent shaft, and the débris from these numberless shafts has spread over many thousands of acres of land, rendering the surface too uneven for agriculture. "Here and there, in depressions," writes Professor Fisher, "I found a small vegetable garden and orchard, but the rest of the land consists of heaps of shale, which has disintegrated into a clayey loam, and is covered with a coarse growth of grass, presumably used for sheep pasture, though I saw no sheep on it. I was told that it cost about £100 an acre to level this land, and the present state of agriculture in England would not warrant this expenditure. What it would grow, and grow well, is a crop of trees; but the obvious difficulty in the way of such a proposal lies in the danger to the growing trees from the noxious fumes of the surviving manufactories. In order to find out how far this was a still-existing danger in the Black Country, Professor Fisher invited Mr. Harbord, the Chemical Analyst to the Government of India at Cooper's Hill, to accompany him to Birmingham, Dudley, Bilston, and the neigbourhood of Wolverhampton. They found that the waste tract which has been described, on which there are now no furnaces, and on which the pits have been closed for years—one of those awful instances of a bit of "used-up England," which suggest to some minds a time when the populous North may become one huge burnt-out cinder-heap—was remote enough from the manufactories both of Wolverhampton and of Bilston, for there to be no danger to trees from acid fumes. Moreover, the the actual number of furnaces at work is not more than one-half of those in blast thirty years ago, and these are better constructed and give out less smoke. The presence of trees is witness to this. "There is fine growth of ash and sycamore and poplar in Dudley 'Park, on the verge of the Black Country, to the west of the Earl 'of Dudley's extensive iron and steel works; there are fine syca'more, ash, beech and even Scotch fir-trees, growing in some private 'grounds, although it is well known that Scotch fir and beech do not 'thrive when exposed to acid fumes." Professor Fisher's conclusion is that there is not sufficient smoke in the Black Country to injure trees, and that the waste land and old pitshafts might be planted, and the hideous scarred country turned into a forest, "if Government or local authorities would support such a measure."

It is not often that such practical proposals result from a "sentimental journey" through a factory-ruined district. A far more usual course is to abuse or deplore the establishment of the factories themselves, which are the result of economic needs that must be stronger than æsthetic antipathies. There is no reason to doubt that in the case of parts of the Black Country, scenery can be restored on the lines suggested by Professor Fisher, and the experiment is as well worth considering by the local governing bodies of the wealthy Midland towns as the project of re-afforesting the Welsh Crown lands by the "sympathetic Commissioner," from whose good offices Sir John Hibbert expects so much. But there are districts in which manufactures are still carried on in such a manner and of such a kind as are incompatible with any restoration of scenery, even supposing it were worth living in the vicinity, were the landscape the finest which could be seen. Take, for instance, that "chemical" district west of Manchester, of which Widnes and St. Helens are the commercial centres. In this scene of unrivalled British enterprise, the ground is like a dead sea-shore of alkali waste, the air smells horribly all day and all night, trees die, eyes smart and lips are dry and cracked from chemical fumes, and soda, glass bottles, and pills in millions are the result to civilisation. They will go on being made, and the trees will go on dying, until the world has enough soda, glass bottles, and pills, or till it does not pay to make them. In Jarrow-on-Tyne, the other centre of the chemical industry, the fumes killed all the trees on the hilltops like a frost, but spared those in the valleys. It is said that they too are dying. The river is fringed for miles with old-established chemical works, dating in many cases from a time when waste and carelessness in manufacture were unchecked by the invention of improved processes abroad, the manufacture of chemicals was conducted at a minimum of profit to the owner, with a maximum of injury to vegetable life, and interference with human comfort. Improved methods of manufacture, which turn the noxious "waste products" into something useful, are the great protection to trees and vegetation, and such improvements are being introduced at Jarrow. But the scenery of Tyneside is not yet ripe for restoration; and if our fiery districts are cooling from the centre, as seems probable, the Midlands seem the natural and best locality for an experiment in the restoration of scenery.—(*Spectator*, *August 25th, 1894*).

VII.—TIMBER & PRODUCE TRADE.

Churchill and Sim's Circular.

September 5th, 1894.

East India Teak.—The deliveries for the first eight months of the year are 7,754 loads against 8,783 loads in the same period of 1893, while for August they came out at 817 loads against 1,157 loads in August, 1893. The London Stock continues very moderate, and prices tend to improve. They would do so much more markedly but for the figures of the floating supply and the number of slips chartered to load. This prospective supply promises to meet, however, with a sufficiently widespread and general demand to prevent the probability of any undue proportion of it pressing very severely on any one market.

Red-Wood.—Is in very limited demand, although stock is small.

Satinwood.—Plain wood is dull ot sale, but figury logs are in good demand.

Ebony.—There is more enquiry, and really good logs bring satisfactory prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superficial	6d.	to	12d.
Rosewood	,, ton	£5.	to	£8.
Ebony	,, ton	£6.	to	£8

MARKET RATES OF PRODUCTS.

Tropical Agriculturist, September, 1894.

Cardamoms	per ℔.	2s.	to	2s. 6d.
Croton seeds	per cwt.	20s.	to	27s. 6d.
Cutch	,,	20s.	to	32s.
Gum Arabic, Madras	,,	15s.	to	30s.
Gum Kino	,,	£15	to	£18.
Indian Rubber, Assam,	per ℔.	1s. 7d.	to	2s. 2d.
,, Burma	,,	1s. 7d.	to	2s.
Myrabolams, Bombay,	per cwt.	7s. 6d.	to	9s. 3d.
,, ,,	,,	3s. 6d.	to	4s. 3d.
,, Godavari	,,	6s.	to	6s. 9d.
Nux Vomica, good	,,	6s.	to	10s.
Orchella, Ceylon	,,	15s.	to	22s.
Redwood	per ton	£3. 10s.	to	£4
Sandalwood, logs	,,	£35	to	£55
,, chips	,,	£9	to	£30

THE

INDIAN FORESTER.

Vol. XX.] November, 1894. [No. 11

Recruits for the Upper Controlling Staff of the Forest Department.

Some information with regard to the nature of the examination which competitors for the Indian Forest Department are now required to pass, appeared in the January number of *The Forester* of the present year. The results of the examination held for condidates for six appointments to the Indian Forest Department last June are now public property, and a few additional remarks with regard to the arrangement of the subjects, which may now be taken up and its effect on the character of the examination, may be of interest to your readers.

The subjects which may be taken up are, as was the case in June, 1893, divided into three classes :—

Class I.—*Obligatory.*

Class II.—*Optional*, with the proviso that only two of the nine subjects which are included in this course, may be taken up by any one candidate.

Class III.—*Voluntary.* This term embraces a small group of subjects, which may *all* be taken up—and were all taken up—by every candidate.

Class I includes Elementary Mathematics, English Composition and German.

Class II contains Higher Mathematics, French, Latin, Greek, English History, Elementary Botany, Elementary Chemistry, Elementary Physics and the elements of Geology.

Class III consists of Freehand and Geometrical Drawing. Thirty-nine men presented themselves for the six places offered for competition, and every candidate in addition to the obligatory subjects took up both the voluntary subjects included in Class III.

This seems to indicate that the candidates would have all taken up more subjects if they had been allowed to, and that the system at present in force has a tendency to confine the knowledge of a candidate within comparatively narrow limits.

The maximum number of marks which a candidate could obtain was 10,300, and of this number the first man got 6,883, and the last successful candidate obtained 6,501, and the 39th man 3,140, Had any of the first six men omitted to take up the voluntary subjects, they would not have obtained an appointment. All the successful candidates, with one exception, obtained more than half marks in each of the obligatory subjects.

Of the optional subjects 34 men out of the 39 candidates took up French, 28 took up Latin, 7 Chemistry, 7 Geology, 3 Physics, 3 English history, 2 Botany. No one took up Greek, which seems to point to the influence of the modern school side of the public educational establishments of the present day.

It is a matter for congratulation that so many candidates took up French as one of their optional subjects, but it is much to be regretted that of the whole number of candidates who presented themselves for examination, only 3 selected two of the branches of Natural Science as their two optional subjects, and also that neither of these men were among the successful candidates. Of the remaining competitors, only 13 attempted even one of the four branches of Natural Science open to them!

The competitive examinations for Forest officers and Police officers are, it is understood, identically the same, and are held together. This arrangement may save the examiners trouble, but is it possible to bring together two professions which have so little in common? A Forest officer must be, or be made, more or less a scientific man, and should be essentially a student of nature; while a Police officer requires no science, and has chiefly to learn the characteristics and peculiarities of his fellow men, and yet one and the same examination is held to be sufficient test for the selection of men for both these services!

Forestry has long been practised in France, under much the same wide conditions as in India, and as the Indian Forest service has been so long and so intimately connected with the French service, a thorough knowledge of French is just as important to an Indian Forest officer as is a good and sufficient knowledge of German. French is more generally taught at schools, and is more easily acquired, at any rate up to the standard required to enable a forest officer to travel with profit in France, and to read professional works in French with advantage. It ought to be certainly, therefore, a compulsory subject just as much as German is. The Entrance examination test in 1885, the first year that men were sent to Coopers Hill, was similar to that which was in vogue when men were sent to France. All the subjects, with three exceptions, were compulsory. These three exceptions were Free-hand drawing, Geology and Mineralogy, and, I think, Botany. The elements of Physics, Chemistry and Mechanics were all compulsory subjects, and rightly so.

The changes in the syllabus of the competitive examination appear to have been made with a view to attract public school men, as the subjects which are required seem to have been altered so as to fit in with the ordinary school curriculum, where the modern side has not been properly developed. The result of the change of the syllabus has been that men who have no knowledge of the chief branches of natural science are attracted, instead of, as formerly, men who had devoted a considerable proportion of their time to those subjects.

Only one of the six successful candidates at the examination held in June and July last, took up any of the branches of natural science, and he only took up one of the newer branches offered, namely Physics! Of course, it may be urged that the natural sciences are taught at Coopers Hill, but is it not a fact that they can be taught equally well elsewhere? And also that if the men who now enter the Forest Department were required, as they were formerly, to have a thorough knowledge of Elementary Chemistry, Physics and Geology, more time would be available for their instruction in those subjects which they should know and which cannot be thoroughly acquired in public schools and similar educational establishments?

A man who has studied science for pleasure, should, other things being equal, make a better Forest Officer than one who has no inclination for scientific subjects, and consequently natural science should be required from such students as offer themselves as candidates for the Forest Department, in order to ensure, as far as is possible, their having a taste for those subjects which, when developed, will prove most valuable to a Forest Officer.

A third year has lately been added to the course of instruction of Forest Officers at Coopers Hill. May it not be that those advantages which ought to accrue from this third year are annulled to a great extent, by the fact that now students have to devote their first year to courses of Chemistry, Physics and Geology, none of which were *necessary* in the case of the students who passed in under the old régime.

Under that régime, at first, French and German were obligatory subjects in turn, and latterly French was made obligatory and German entirely dropped. This was, of course, a mistake, as one language is as important to a Forest Officer as is the other; but now the pendulum has swung to the side of German to the neglect of French, and is not this just as bad as the total neglect of German?

A two years' course at Coopers Hill was considered to be too short, but is much time gained by increasing it to three years, if at the same time three extra subjects are added, and Botany has to be taught from the very commencement?

From the first, forest students have been required to attend the College lectures in Geology and Physics, but this was quite unnecessary in view of the character of the examination which the successful competitor had already gone through.

The ordinary college course of Chemistry is very much longer, and takes up very much more time than either Physics or Geology, and if the forest students are to follow this course, and learn as well organic chemistry, which does not form a part of the ordinary college curriculum, the time at their disposal for the other subjects which they are to learn will be necessarily considerably shortened.

In order that full advantage may be taken of the extra year at Coopers Hill, an elementary knowledge of lower mathematics is necessary, and an elementary knowledge of Latin, and possibly Greek, will be found useful, in so far as they enable the student te analyse the exact meaning of the numerous scientific terms which will be met with in the study of the different branches of natural science. These subjects, as well as a good knowledge of elements of Physics, Chemistry and Geology, should be obtained at a public school before entering the College, and then the third year can be utilized in teaching those subjects which particularly and peculiarly belong to the training of a forest officer. Given two men of equal ability, it stands to reason that a man who has a knowledge of and presumably a liking for the natural sciences, such an Botany, Chemistry and Physics, would be undeniably preferable and better qualified as a forest officer than one who has simply passed into the department on his knowledge of Higher Mathematics, Latin or Greek. One would like to see the syllabus of the entrance examination altered, so as to bring it more in accordance with the old régime; so that Class I—*obligatory*—should contain Elementary Mathematics, English Composition, German, French, and the elements of Chemistry, Physics and Geology; that Class II should be done away with, and that Class III—*voluntary*— should embrace Botany, and, as at present, Freehand and Geometical Drawing.

Botany, with especial reference to forestry, is very thoroughly taught at Coopers Hill, and the course is especially adapted to the requirements of a forest officer in a way which cannot be done at other institutions where general botany is taught, and it is considered desirable that this subject should be taught from the very beginning at the College.

C. G. R.

Punishments for Cattle trespass.

In a Note on Forest Policy in Bombay, published last month in the *Forester*, the Inspector General of Forests expresses his views on the procedure adopted in the matter of cattle trespass. The question is of importance and justifies discussion. Mr. Ribbentrop is averse to the award of a double punishment under the same law; he would rather (1) increase the pound fees, (2) withdraw the grazing concession, or (3) increase the grazing fees charged. The award of double punishment under the same law is, doubtless, in the abstract, repugnant to a sense of justice, but there is no novelty in the proceeding, nor do those who are so punished resent the punishment from this point of view. In the case of field trespass by swine, these animals may, I believe, be impounded, *and* the owner prosecuted for permitting the trespass. Simple impounding is thus not deemed to be sufficiently deterrent where much damage may be caused to the crops.

Forest trespass is more difficult to prevent than field trespass, and it is not apparent why one and the same procedure should be deemed unjust when applied to forests, and suitable when applied to arable lands. Personally, I am of opinion that the so-called double punishment is ideal, as the Magistrate in sentencing a trespasser would invariably take into consideration the amount already paid for releasing his cattle from the pound. To consider the alternatives proposed: first, to increase the pound fees; this would prevent a discrimination between the casual and habitual offender, and would level up all offences, whether committed by carelessness or by intention. It would also intensify the results of vexatious impounding, a so common outcome of personal animus in this country.

Secondly, the withdrawal of the privilege of grazing at reduced rates; and, *thirdly*, the increase of the normal grazing fees. These two proposals may well be considered together, in each, the community might be punished for the faults of individuals, in each, the action taken would not be deterrent unless the increased payment more than covered the value of *systematic* illicit grazing. It goes without saying that a village community thus punished would not, in the basis of this discussion, be otherwise proceeded against for continued trespass. The total prohibition of grazing to a village is too drastic a measure, it involves the existence of the agriculturalist; the increase in grazing dues tends in the same direction, and might, in a community, arrive near the same result before it was effective in individual cases.*

---

* For instance the habitual offenders in a community might be of the cattle breeding castes, with no interest in agriculture. The agriculturalists might be unable to prevent the trespass, and yet be made to suffer severely by the imposition of increased grazing dues.

I venture to bring forward a fourth proposal which would obviate the difficulty of the double punishment, and yet permit the Forest Officer to discriminate between degrees of offences and the Magistrate to award punishment proportionate thereto. This proposal is to abolish pound fees for forest pounds, but to continue to use these institutions as a sure and, at present, the only means at our disposal for the identification of trespassers. The Forest Officer must be in a position to deal with the habitual offender (whose sentence may be, and often is, three months' rigorous imprisonment and Rs. 100 fine) and the careless herd who is released on payment of pound fees, or compounds his offence by disbursing a trival sum. The registers of the law courts afford the proofs of habitual misdeeds; to punish solely by impounding would be to do away with this information, and so prescribe one punishment for offences which vary in degree.

Little need be said as to the working details of the proposal. The up-keep of forest pounds would involve an expense which the finances of the Department could well bear. The pound keeper would be an official of local knowledge not liable to be deceived by fictitious names and addresses. The receipt of the owner of the cattle on removal would be taken as evidence of ownership, and the Magistrate before whom the case would be decided, would know how to deal with any complications which might arise under the new system of the abolition of pound fees.

O. C.

Modification of French Forest Law as regards the power to give light sentences in the case of forest offences.

A proposition has been presented to the French Chamber of Deputies, with the object of bringing about a modification of Section 203 of the French Forest Code, which at present prohibits the application of the attenuating circumstances of Section 463 of the Penal Code to forest offences.

The proposers of the modification maintain that there is no reason why the Forest Law should be the only law which leaves no power of appreciation with the Courts. A judge who convicts under the present law, is obliged to award a certain sentence which, in many cases, is out of all proportion to the offence committed; the only alternative he has to awarding an unduly severe sentence is to acquit, which is obviously equally undesirable. To take an example. In the case of cattle trespass, Section 199 fixes the fine at so much a head; no discrimination is allowed as to whether the damage caused was grave or trivial, whether the trespass was an accident or owing to ignorance, or was of deliberate intent. The offence exists by the simple fact of the trespass, and there is no question of anything else.

Again, when damages are recoverable from an offender, they cannot, by Section 202 of the Forest Code, be less than the fine awarded, whatever may be the extent of damage ; and it is obvious that in many cases to award the minimum damages fixed by the Code would be equally unjust as to refuse to award damages at all, between which limits there is no middle course.

The arguments in favour of the present order of things appear to be based chiefly on two considerations. First that a rigorous law is indispensible for the proper conservation of the forests. As to this, it seems more than probable that its very rigor is the cause in many cases of its inefficacy, as, for instance, in such cases as those in which the Court has to choose between an acquittal and a sentence to a punishment out of all proportion to the offence. Secondly, it is alleged that the Forest Administration is invested with the right of compounding forest offences, and that it is thus able to modify, when necessary, the severity of the forest law. That forest officers should be authorized to compound offences is, of course, quite right and proper, but the exercise of the authority depends, after all, on the individual ; and without denying that a conciliatory spirit is generally displayed by officers of the department, yet the proportion of cases compounded naturally varies with the officer competent to accept composition. The proposers of the modification in question maintain that even supposing forest officers were never influenced by any other considerations but those of justice in accepting or refusing composition, yet the power to admit of attenuating circumstances is none the less necessary for the Courts. The power to accept composition exists also under other laws, but has not in any other case prevented the admission of attenuating circumstances by the Courts.

The following article appears in *Le Bois* on this subject :—

"It would be easy to reply that the Forest Code was drawn 'up with a perfect understanding at all points in order to protect 'efficaciously forest property, and more especially that of the State 'and the Communes in the interests of the country at large, that 'it was necessary to adopt severe measures to repress old-standing 'and numerous abuses ; but that as the conditions became simpler, 'the rigour of the law has been considerably moderated without 'actually altering the text, that notably the system of compound-'ing offences so largely made use of in the Forest Administration 'has long since procured all the leniency which is compatible with 'the up-keep of the forests. In our time, however, the general 'good of the country at one time so deep and lively a sentiment, 'has now given place to electoral interests, it is therefore extremely 'probable that the Chamber will receive favourably the project 'which has been submitted to it.—(*From the Revue des Eaux et 'Forêts.*")

II.—CORRESPONDENCE.

Value of 'Pynkado' for Sleepers and Paving Blocks.

SIR,

As there has been some correspondence in the papers lately on the subject of the value of *Xylia dolabriformis* for railway sleepers and for wood-paving purposes, the following extracts from home reports of the value of the wood in the London market will be interesting :—

"We have examined your plank of wood per *Arapalu*, and find same to be a very hard wood, close grained and with a 'strong tendency to split on the flat side, it does not appear to 'possess any special merit, and we do not think shipments would 'realise enough to cover freight and charges, and we certainly can'not recommend you to make any consignments."

Another report says :—

"We have not yet found anyone to take an interest in the 'Jamba. It is so hard that the expense of cutting into blocks would 'be excessive, and the railway Companies here will not use it for 'sleepers, as it makes the trains too noisy, they insist on having 'pine-wood, which being more springy is quieter."

The North Kanara forests in the Bombay Presidency could supply 1 to 2,000 tons of this timber annually at Rs. 40 per ton delivered at the railway-stations of Alnawur or Londa, Southern Mahratta Railway.

W. A. TALBOT,
D. F. O., N. Dn., Kanara, Bombay.

Albizzia lophantha at the Cape.

SIR,

In a recent number of the *Indian Forester* I notice your remarks about *Albizzia* or *Acacia lophantha*. My opinion of it quite coincides with yours : and I am at a loss to understand why the Punjab Forest Department should seek to propagate it. In the Cape Peninsula it is a naturalized weed, in the sense that it overruns fertile ground, but will not grow in dry or poor localities. On the fertile slopes of Table Mountain it grows in many places like

Acacia dealbata on the Nilgiris. In dry localities on the mainland, where other wattles, notably *Acacia Cyclopis* (?) flourish, *A. lophantha* is never seen. Its bark is worthless for tanning purposes. It is notorious in Cape gardens as being the chief home of that pest of all pests, the Australian bug, *Icerya Purchasi*. There are 2 species of wattle that, judging from S. African experience, are most likely to succeed in the Punjab, *Acacia Cyclopis* and *A. saligna*. Both are quite naturalized in S. Africa. We collect tons of the seed yearly for re-foresting, chiefly for the barren sands of the Cape flats. The *saligna* wattle furnishes a good tanning bark, largely used in local tanneries. The *Cyclopis* wattle is of no value for tanning purposes, but does well on barren hillsides and on limestone ; it is now found all along the coast of S. Africa, especially at Port Elizabeth and Mossel Bay.

The valuable black wattle, *A. decurrens*, has no doubt been well tried on the Himalayas. As a curiosity I send you South African seed of this and of the other very valuable tan wattle, *A. pycnantha*.

CAPETOWN,
August 28th, 1894.

D. E. HUTCHINS,
Cons. Forests.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Resolution on the Forest Policy of the Government of India.

In Chapter VIII of his Report on the improvement of Indian Agriculture, Dr. Völcker dwells at length upon the importance of so directing the policy of the Forest Department that it shall serve agricultural interests more directly than at present; and in his Review of Forest Administration for 1892-93, the Inspector-General of Forests discusses in some detail the principles which should underly the management of State forests in British India. While agreeing generally with the principles thus enunciated by the Inspector-General of Forests, the Government of India think that it will be convenient to state here the general policy which they desire should be followed in this matter; more especially as they are of opinion that an imperfect apprehension of that policy has, in some recent instances, been manifested.

2. The sole object with which State forests are administered is the public benefit. In some cases the public to be benefitted are the whole body of tax-payers; in others, the people of the tract within which the forest is situated; but in almost all cases the constitution and preservation of a forest involve, in greater or less degree, the regulation of rights and the restriction of privileges of user in the forest area which may have previously been enjoyed by the inhabitants of its immediate neighbourhood. This regulation and restriction are justified only when the advantage to be gained by the public is great; and the cardinal principle to be observed is that the rights and privileges of individuals must be limited, otherwise than for their own benefit, only in such degree as is absolutely necessary to secure that advantage.

3. The forests of India, being State property, may be broadly classed under the following headings:—

(*a*) Forests, the preservation of which is essential on climatic or physical grounds.

(*b*) Forests which afford a supply of valuable timbers for commercial purposes.

(*c*) Minor forests.

(*d*) Pasture lands.

It is not intended that any attempt should be made to class existing State forests under one or other of these four heads. Some forests may occupy intermediate positions, and parts of one and the same forest may fall under different heads. The classification is useful only as affording a basis for the indication of the broad policy which should govern the treatment of each class respectively; and in applying the general policy, the fullest consideration must be given to local circumstances.

4. The first class of forests are generally situated on hill slopes, where the preservation of such vegetation as exists, or the encouragement of further growth, is essential to the protection from the devastating action of hill torrents of the cultivated plains that lie below them. Here the interests to be protected are important beyond all comparison with the interests which it may be necessary to restrict; and, so long as there is a reasonable hope of the restriction being effectual, the lesser interests must not be allowed to stand in the way.

5. The second class of State forests include the great tracts from which our supply of the more valuable timbers—teak, sál, deodar, and the like—is obtained. They are for the most part (though not always) essentially forest tracts, and encumbered by very limited rights of user; and when this is the case, they should be managed mainly on commercial lines as valuable properties of, and sources of revenue to, the State. Even in these cases, however, customs of user will for the most part have sprung up on the margins of the forest; this user is often essential to the prosperity of the people who have enjoyed it; and the fact that its extent is limited in comparison with

the area under forest renders it the more easy to continue it in full. The needs of communities dwelling on the margins of forest tracts consist mainly in small timber for building, wood for fuel, leaves for manure and for fodder, thorns for fencing, grass and grazing for their cattle, and edible forest products for their own consumption. Every reasonable facility should be afforded to the people concerned for the full and easy satisfaction of these needs, if not free (as may be possible where a system of regular cuttings has been established), then at low and not at competitive rates. It should be distinctly understood that considerations of forest income are to be subordinated to that satisfaction.

There is reason to believe that the area which is suitable to the growth of valuable timber has been overestimated, and that some of the tracts which have been reserved for this purpose might have been managed with greater profit both to the public and to the State, if the efforts of the Forest Department had been directed to supply the large demand of the agricultural and general population for small timber, rather than the limited demand of merchants for large timber. Even in tracts of which the conditions are suited to the growth of large timber, it should be carefully considered in each case whether it would not be better, both in the interests of the people and of the revenue, to work them with the object of supplying the requirements of the general, and in particular of the agricultural, population.

6. It should also be remembered that, subject to certain conditions to be referred to presently, the claims of cultivation are stronger than the claims of forest preservation. The pressure of the population upon the soil is one of the greatest difficulties that India has to face, and that application of the soil must generally be preferred which will support the largest numbers in proportion to the area. Accordingly, wherever an effective demand for culturable land exists, and can only be supplied from forest areas, the land should ordinarily be relinquished without hesitation; and if this principle applies to the valuable class of forests under consideration, it applies *à fortiori* to the less valuable classes which are presently to be discussed. When cultivation has been established, it will generally be advisable to disforest the newly-settled area. But it should be distinctly understood that there is nothing in the Forest Act, or in any rules or orders now in force, which limits the discretion of local Governments, without previous reference to the Government of India (though, of course, always subject to the control of the Government) in diverting forest land to agricultural purposes, even though that land may have been declared reserved forest under the Act.

7. Mention has been made of certain conditions to which the application of the principle laid down in the preceding paragraph should be subject. They have for their object the utilization of the forest area to the greatest good of the community. In the firs

place, the honey-combing of valuable forests by patches of cultivation should not be allowed ; as the only object it can serve is to substitute somewhat better land in patches for sufficiently good land in large blocks, while it renders the proper preservation of the remaining forest area almost impossible. The evil here is greater than the good. In the second place, the cultivation must be permanent. Where the physical conditions are such that the removal of the protection afforded by forest growth must result, after a longer or shorter period, in the sterilization or destruction of the soil, the case falls under the principle discussed in paragraph 4 of this Resolution. So again, a system of shifting cultivation, which denudes a large area of forest growth in order to place a small area under crops, costs more to the community than it is worth, and can only be permitted, under due regulation, where forest tribes depend on it for their sustenance. In the third place, the cultivation in question must not be merely nominal, and an excuse for the creation of pastoral or semi-pastoral villages, which do more harm to the forest than the good they reap from it. And in the fourth place, cultivation must not be allowed so to encroach upon the minimum area of forest which is needed in order to supply the general forest needs of the country, or the reasonable forest requirements, present and prospective, of the neighbourhood in which it is situated. In many tracts cultivation is practically impossible without the assistance of forests, and it must not be allowed to destroy that upon which its existence depends.

8. It has been stated above that the forests under consideration are generally, but not always, free from customs of user. When, as sometimes happens, they are so intermingled with permanent villages and cultivation that customary rights and privileges militate against their management as revenue paying properties, the principles laid down at the end of paragraph 5 of this Resolution should be observed, and considerations of income should be made secondary to the full satisfaction of local needs. Such restrictions as may be necessary for the preservation of the forest, or for the better enjoyment of its benefits, should be imposed ; but no restriction should be placed upon reasonable local demands, merely in order to increase the State revenues.

9. The third class of forests include those tracts which, though true forests, produce only the inferior sorts of timber or the small growths of the better sorts. In some cases the supply of fuel for manufactures, railways, and like purposes, is of such importance that these forests fall more properly under the second class, and must be mainly managed as commercial undertakings. But the forests now to be considered are those which are useful chiefly as supplying fuel and fodder or grazing for local consumption; and these must be managed mainly in the interests of the population of the tract which supplies its forest requirements from this source. The first object to be aimed at is to preserve the wood

and grass from destruction; for user must not be exercised so as to annihilate its subject, and the people must be protected against their own improvidence. The second object should be to supply the produce of the forests to the greatest advantage and convenience of the people. To these two objects all considerations of revenue should ordinarily be subordinated.

10. It must not be supposed from the preceding remarks that it is the intention of the Government of India to forego all revenue from the large areas that are valuable chiefly for the fuel and fodder which they yield. Cases must be distinguished. Where the areas in question afford the only grazing and the only supply of fuel to villages which lie around or within them, the necessities of the inhabitants of these villages must be treated as paramount, and they should be satisfied at the most moderate rates, and with as little direct official interference as possible. But where the villages of the tract have already ample pasture grounds attached to their cultivation and owned and managed by themselves, and where the Crown lands merely supplement these pastures and afford grazing to a nomad pastoral population, or to the herds that shift from one portion of the country to another with the changes of the season, Government may justly expect to reap a fair income from its property. Even in such cases, however, the convenience and advantage of the graziers should be studiously considered, and the inhabitants of the locality, or those who habitually graze over it, should have a preferential claim at rates materially lower than might be obtained in the open market. It will often be advantageous to fix the grazing demand upon a village or a nomad community for a year or a term of years. The system, like every other, has difficulties that are peculiar to it; but it reduces the interference of petty officials to the lowest point, and minimizes their opportunities for extortion and oppression. Where grazing fees are levied *per capita*, free passes are often given to a certain number of cattle. In such cases the cattle which are to graze free should include, not only the oxen which are actually employed on the plough, but also a reasonable number of milch cattle and calves. A cow or a buffalo is as much a necessity to a cultivator, using the word necessity in a reasonably wide sense, as is a plough-bullock; and in many parts, the oxen are bred in the village.

11. In the portions of his report which are referred to in the preamble to this Resolution Dr. Völcker strongly recommends, the formation of fuel and fodder preserves, and the Government of India has repeatedly urged the same policy upon local Governments. The question whether any particular area can be made to support a greater number of cattle by preserving the grass and cutting it for fodder, or by permitting grazing upon it, is one that must be decided by the local circumstances of each case. But when it has been decided, the issues are by no means exhausted. It has been stated in paragraph 9 above that one main object

towards which the management of these minor forests should be directed is, the supply of fuel and fodder "to the greatest advantage and convenience of the people." In doing so, due regard must be had to their habits and wishes. It may be that strict preservation and periodical closures, or the total prohibition of grazing, will result in the largest yield both of fuel and of fodder in the form of hay. But that is of small avail if the people will not utilize the increased supply in the form in which it is offered them. The customs of generations alter slowly in India; and though much may and should be done to lead the people to their own profit, yet it must be done gently and gradually, always remembering that their contentment is no less important an object than is their material advantage. It must be remembered, moreover, that the object of excluding grazing from the preserves in question is the advantage of the *neighbourhood*; and that the realization of a larger income than grazing would yield, by preserving the produce, only to sell it to the highest bidder for consumption in large towns at a distance from the preserve, is *not* always in accordance with the policy which the Government of India has inculcated. Here again circumstances must decide. It may be that the local supply of fuel or fodder, independently of the reserved area, is sufficient in ordinary years for the needs of the neighbourhood. In such a case the produce may legitimately be disposed of in such years to the greatest advantage, reserving it for local consumption only when the external supply runs short. Finally, the remarks regarding agency in paragraph 12, and the more general considerations that are discussed below in paragraph 13 of this Resolution, apply in full force to areas thus reserved for the supply of fuel and fodder.

12 The fourth class of forests referred to are pastures and grazing grounds proper, which are usually forests only in name. It is often convenient, indeed, to declare them forests under the Act, in order to obtain a statutory settlement of the rights which the State on the one hand, and private individuals or communities on the other, possess over them. But it by no means follows as a matter of course that these lands should be subjected to any strict system of conservation, or that they should be placed under the management of the Forest Department. The question of agency is purely one of economy and expediency; and the Government of India believe that in some cases where these lands are managed by the Forest Department, the expenditure on establishment exceeds the revenue that is, or at any rate the revenue that ought to be, realized from them.

The following remarks apply, not only to forest lands under the Act, whether administered by the Forest Department or not, but also to all Crown waste, even though not declared to be forest. Here the interests of the local community reach their maximum, while those of the general public are of the slightest nature. It follows that the principles which have been already laid down for the management of minor forests apply, if possible, with even greater force to the management of grazing areas pure and simple.

13. The difficulties which arise in connection with these areas are apt to present themselves in their most aggravated form where the tenure of land is ryotwari. In zemindari tracts the Crown lands generally assume the second of the two forms indicated in paragraph 10 of this Resolution. But where the settlement is ryotwari, every survey number or field that is unoccupied or unassigned is in the possession and at the disposal of Government, and trespass upon it is *primâ facie* forbidden. In some cultivated tracts, these unoccupied and waste lands are the only source available from which the grazing requirements of the resident population can be met. The Government of India are clearly of opinion that the intermixture of plots of Government land which are used for grazing only, but upon which trespass is forbidden, with the cultivation of occupancy or proprietary holders, is apt to lead to extreme abuses, and especially so when these plots are under the management of the Forest Department. The inferior subordinates of the Forest Department are perhaps as reliable as can be expected on the pay which we can afford to give; but their morality is no higher than that of the uneducated classes from which they are drawn; while the enormous areas over which they are scattered and the small number of the controlling staff render effective supervision most difficult. It is not right, in order to protect the grass or the grazing dues on plots of waste scattered over the face of a cultivated district, to put it into the power of an underling to pound or threaten to pound cattle on the plea that they have overstepped the boundary between their owner's field and the next. Still less right is it to permit the exercise of the power of compounding offences allowed by section 67 of the Forest Act, to depend upon the mere report of a subordinate servant, or to expose him to the temptations which such a power holds out. Where the interests involved are sufficiently important, it may perhaps be necessary to accept the danger of extortion while minimizing as far as possible the opportunities for it. But in the case under consideration the interests involved are trifling, while the opportunities are unlimited.

14. It is to be distinctly understood that the Government of India do not desire that grazing should be looked upon primarily as a source of income. But it by no means follows that all revenues from scattered Government lands should be relinquished. It is, indeed, inadvisable that this should be done, as to do so would give the raiyats an interest in opposing allotment and making things unpleasant for new occupants. But the objections to direct management which have just been pointed out are reduced to a minimum or altogether avoided, when the management is placed in hands of the resident cultivators or of representatives

from among them. It will generally be possible to lease or otherwise manage the unoccupied lands of a village through the agency of the community; not, indeed, at the highest price which they are ready to pay to escape such evils as have just been alluded to, but at a moderate estimate of their value to them, fixed in view of the fact that herds and flocks, which cannot exist without grazing, are often a necessary condition of the successful conduct of that cultivation upon which the Government land-revenue is paid. In no case should fields that have been relinquished be let to outsiders at a reduced assessment for grazing purposes, for then we might have speculators taking up such fields, mainly in order to make what they can out of trespassing cattle.

15. One more point of principle remains to be noticed. The procedure under Chapter IV of the Indian Forest Act, whereby forests are declared to be protected, has been in certain cases regarded by the Government of India as a provisional and intermediate procedure, designed to afford time for consideration and decision, with the object of ultimately constituting so much of the area as it is intended to retain, a reserved forest under Chapter II, and of relinquishing the remainder altogether. The Act provides two distinct procedures. By the more strict one, under Chapter II, existing rights may be either settled, transferred or commuted; and this procedure will ordinarily be applied to forests of the first and second classes indicated in paragraph 3 of this Resolution. By the second procedure under Chapter IV rights are recorded and regulated; and this procedure will often be properly followed where the rights to which the area is subject are extensive, and forest is to be managed mainly in the interests of the local community. It will ordinarily be applied to forests of the 3rd and 4th classes. This second procedure may indeed be provisional, and introductory to reservation under Chapter II; but there is in the Forest Act nothing repugnant to giving it a larger and even a permanent operation. As regards Government, the chief difference between the two procedures is, that new rights may spring up in a protected, but not in a reserved forest, and that the record-of-rights framed under Chapter II is conclusive, while that framed under Chapter IV only carries a presumption of truth. It is believed that this presumption offers ample security where the object of regulating the rights is to provide for their more beneficial exercise, rather than to override them in the public interest. As regards the people, the chief difference is that, speaking broadly, in a reserved forest everything is an offence that is not permitted, while in a protected forest nothing is an offence that is not prohibited. In theory it is possible so to frame the permission and the prohibition as to make the results identical in the two cases; but in practice it is almost impossible to do so. If it were not so, the distinction drawn by the legislature would be unnecessary and meaningless. It is only where

the public interests involved are of sufficient importance to justify the stricter procedure and the more comprehensive definition of forest offences, that the latter should be adopted.

The Governor-General in Council desires, therefore, that with regard both to fuel and fodder preserves, and to grazing areas pure and simple, and especially to such of them as lie in the midst of cultivated tracts, it may be considered in each case whether it is necessary to class them, or, if already so classed, to retain them as forest areas ; and if this question is decided in the affirmative, whether it would be better to constitute them protected rather than reserved forests.

19. Such are the general principles which the Government of India desire should be observed in the administration of all State forests in British India. They are fully aware that the detailed application of these principles must depend upon an infinite variety of circumstances which will have to be duly weighed in each case by the local authorities, to whose discretion the decision must be left. One of the dangers which it is most difficult to guard against is the fraudulent abuse of concessions for commercial purposes ; and only local considerations can indicate how this can best be met. The Government of India recognize the fact that the easier treatment in the matter of forest produce which his Excellency in Council desires should be extended to the agricultural classes may, especially in case of true forest areas, necessitate more careful supervision in order that the concession may be confined within its legitimate limits. But, on the other hand, they think that, in some Provinces, it will render possible a considerable reduction of existing establishment ; and they desire that this matter be carefully considered with reference to what has been said above in paragraph 12. They know also that in some Provinces forest policy is already framed on the lines which they wish to see followed in all. But the Governor-General in Council believes that local Governments and Administrations will be glad to receive the assurance now given them, that the Supreme Government will cordially support them in recognizing and providing for local requirements to the utmost point that is consistent with Imperial interests. Where working-plans or plans of operation are framed for forests, the provisions necessary for this purpose should be embodied in them. The exercise of the rights that have been recorded at settlements will necessarily be provided for in these plans. Where further concessions are made by way of privilege and grace, it will be well to grant them for some such limited period as ten years, so that they may, if necessary, be revised from time to time, as the circumstances on which they were moulded change.—(*Gazette of India.*)

(We have printed this long Resolution in full as we believe many of our subscribers, especially those in Europe, may wish to see it. Any remarks we may have to make are deferred to a later number. (Hon. Ed.)

IV.—REVIEWS.

Annual Forest Administration Report for 1892-93 for Bengal, the Punjab and Coorg.

The BENGAL Report is an interesting one for those who are personally acquainted with the forests, but there is not much in its record of hard work, which can be specially referred to or quoted as of special interest. After reading such statements as that of the Director of Agriculture in the Central Provinces, referred to in our last month's number, it is very satisfactory to note the good relations which exist in Bengal between Revenue and Forest officers. The Conservator says :—

" There was an absolute absence of friction between Divisional ' and District officers, and between this department and other ' departments. In every instance do the District officers appear to ' have looked upon the forest administration of the country as a ' part of their own duty, and to have afforded their professional ' forest assistants all the aid in their power. This interest taken ' in forest questions by the District officers, and their appreciation ' of the relative degree of responsibility attaching to themselves ' and their forest assistants in the efficient management of the ' State forests, is one of the pleasantest features of forest adminis- ' tration in Bengal."

Of course, it was only what was to be expected, for an interest in the Department on the part of Lieutenant-Governors and Revenue officers of all grades is traditional in Bengal ; though, perhaps, something may also be set down to the fact that most of the forest areas are in out-of-the-way localities, and not mixed up with the agricultural country as they are in parts of Central, Southern and Western India. The main districts of Bengal and Behar are, of course, under the Permanent Settlement, and consequently the Department has nothing to do with them. As usual, the most interesting matter to our readers are to be found in the portion of the Report which deals with reproduction. The remarks on reproduction in the Sundarbans have been thought worthy of quotation in the Local Government Review, and we give them also :—

" In the Sundarbans forests conditions are so favourable to ' vegetation that we note without wonder the account which the ' Divisional Officer gives of a new island, three miles long, that 'appeared above the waters of the Pancassia river in 1891, having 'by this time covered over to a great extent with bushes fifteen 'feet high of Keora (*Sonneratia apetala*), Ora (*Sonneratia acida*), 'Bain (*Avicennia officinalis*), a few seedings of Golpatta (*Nipa 'fruticans*), and quantities of wild rice (*Oryza sativa*).

'Reproduction of tree growth in the Sundarbans forests is, 'indeed, a curious sight to see. Seedlings of Gengwa (*Excœcaria 'Agallocha*) may be perceived on the shelving banks of the rivers 'coming up as thickly as the best crops of paddy. The majority 'of the species shed their seed during the rains, and this seed is 'then floated by the tides—which attain their highest level at that 'season of the year—in immense quantities (and often in a state 'of germination as they float along) well into the interior of the 'innumerable islets which go to form this singular region."

and the Conservator's remarks upon Angúl are also most interesting, for these beautiful sal forests of Orissa are, like those of Ganjam further south, quite different in character to much of what is found in the Sub-Himalayan region :—

"The splendid sal reproduction to be seen in those beautiful 'forests of Angúl that stretch along the Mahanadi river surprised 'the Inspector-General of Forests himself, and it is a pity that the 'absence of a market for the excessive proportion of inferior 'species found in these forests should not enable us to foster, as 'we would wish, the evident bent of the sal in this locality to 'extend itself over the whole of the Tikarpara-Bagmunda Range. 'We should like to cut away or girdle the trees that oppose their 'heavy cover to the spread of the more valuable sal, but the small 'demand for the produce and the danger of accumulating inflam-'mable rubbish on the ground give us but small latitude in the 'matter."

The Conservator, Mr. Dansey. complains feelingly of the difficulties he has to contend with in a huge Circle with an insufficient staff, and he instances the fact that the Chittagong Division changed hands no less than seven times during the 15 months, and three times directly afterwards, making 10 changes in 18 months.

The financial results of the year were :—

	Forest year, 15 months.	Financial year.
Receipts ...	9,04,803	7,44,882
Charges ...	4,74,586	3,81,608
Surplus ...	4,30,217	3,63,274

both *gross* and *net* revenue being only a little less than in the previous year.

The PUNJAB Report has been a melancholy one to read. All through it shows the characteristic opinions and style of its writer, Mr. R. H. C. Whittall, whose sudden death the Government of

India have referred to with regret. It is besides, as the Government of India have also remarked, an interesting Report, clearly showing the state of affairs as regards forest conservancy in the Punjab at the present time.

The area of forest, at the end of the year, contained the following :—

			sq. miles.
Reserved	(1)	Departmental	1,634
	(2)	Military	42
	(3)	District	70
Protected	(1)	Departmental	67
	(2)	District	131
Unclassed			5,670
		Total	7,614

there having been a slight decrease during the year owing to the giving up of areas for cultivation along the Chenab canal line. The Report gives a formidable list of areas for which Working Plans are needed, and most especially instances Kulu and Kaghan as being British tracts and requiring the present employment of capital more than their neighbours, the Leased Forests. In regard to the Working Plans for the 'rakh' lands of Multan and Montgomery the Conservator says :—

" Next in order of importance come the areas which feed the ' North-Western Railway with fuel ; these are in Montgomery, 240 ' square miles, and in Multan about 70. The Reserved forests are ' not of sufficient extent to maintain the supply, and Government ' have hitherto shown themselves unwilling to extend reservation. ' So that if Working Plans are made they must embrace tracts of ' unclassed forests where the rights are unknown and unrecorded, ' and where the grazing restrictions are not likely to fulfil forest ' requirements.

' In these rakhs no very scientific forestry is required. Local ' Dehra-trained Rangers can, under proper check, do the field ' work ; the only difficulty is the grazing and the fitting of it in ' with the cuttings, and I fear that unless the grazing restrictions ' during the time young forest is growing up are made more rigid, ' it will be impossible to include areas of unclassed forest in the ' Working Plans. The subject is receiving local attention. ' In Multan many forests have been described compartment by ' compartment, the rotation decided upon, and the sequence of ' fellings, while we hope that an increase to the reserved area may ' be permitted. In Montgomery, the area necessary to supply the ' railway, about 240 square miles, has been roughly mapped, ' divided into large blocks and estimated, and the question is being ' considered whether the restrictions to grazing granted by Sir ' James Lyall in 1889 over the unclassed portion of about a lakh 'of acres will permit of a regular programme of working being 'adopted."

In regard to the natural reproduction the report has much of interest in respect to the sylviculture of deodar, blue pine, spruce and silver fir, so we need not offer apologies for making a lengthy extract :—

"HAZARA.—Mr. Gisborne Smith reports that natural reproduction of silver fir is not so deficient as has generally been 'supposed. It is worst on the higher and moister slopes where 'dense undergrowth prevails. In a few selected places, a certain 'amount of grazing, under strict regulation has been permitted, as 'the cheapest way of keeping down this undergrowth. In Kaghan 'natural reproduction of deodar is good, especially where light 'grazing takes place.

'RAWALPINDI.—The absence of fires for now three successive 'years has had a most marked effect on the vegetation in the 'Murree and Kahuta hills. And Mr. Forrest also states that the 'damage from grazing is not so great as is generally supposed, 'because in these hills the grazing is, as yet, light.

'CHAMBA.—All that Mr. MacIntire has to say on this subject 'is always interesting, and I agree with him that light grazing to 'keep down the rank herbaceous growth, which is the greatest 'enemy the young deodar seedling has, is not only permissible but 'necessary. Grazing of kine on steep hill slopes can never be 'heavy as it is in the plains where animals herd together ; and 'when the numbers and the seasons of admittance can be regulated, grazing may often be permitted, in the hills only, where we 'have been in the habit of rigorously excluding it. It was noticed 'that the ground near seed-bearers, the seed being plentiful, was 'often more covered with seedlings when the soil had not been 'wounded or terraced than where these works had been undertaken. This seems to point to the abandonment of the idea of 'preparing the soil for the reception of naturally deposited seed. 'I quote the following from the Divisional Report as well worthy 'of attention.

" But no practical plan of saving such seedlings from destruction, such as has overtaken nearly all germinating in previous 'years, has been thought out. It has been noticed that shade does 'not seem to hinder the germination of such seedlings whatever 'its results may be as they grow older. And as most, or nearly all, 'of the seedlings are well rooted in the soil, it is difficult to believe 'they die out mainly because they germinate among dead leaves 'and vegetable humus, which are usually far from covering up the 'soil to any considerable depth Also, as the death-rate from 'drought in deodar nurseries sown in exposed places is generally 'small, it cannot be supposed that drought is the principal obstacle 'to their establishment. There seems to be no way out of supposing that the principal reason why so few deodar seedlings establish 'themselves is that in most situations they are at first incapable 'of fighting other forms of vegetation which are produced.'

'In the Kalatop Forest, the seedlings of spruce and silver fir 'on the contrary, at ordinary elevations seem capable of establishing themselves amongst and growing through other vegetation.

'This is just what the silver fir in the Dungagaili Range of 'Hazara does not appear able to do.

'KANGRA.—In Kangra, natural reproduction has been materially improved in the Chil and bamboo forests by the removal of 'dense undergrowth, and in the bamboo forests by the exclusion 'of grazing during the three rainy months.

'KULU.—In Kulu, the deodar seeded profusely, and owing to 'favourable climatic reasons the show of natural seedlings is said 'to be magnificent, in places whole nurseries of self-sown deodar 'having been formed. The Divisional Officer still complains of 'the excessive grazing by sheep and goats.

'BASHAHR.—The report from Bashahr is also interesting and 'the rapid spread of the blue pine forming pure forest over 'formerly treeless tracts is remarked on at length. Mr. Minniken 'also notices what has been frequently observed on previous 'occasions in Chamba, *viz.*, that where the deodar in a mixed 'forest is rare, there is little hope of perpetuating it. This is 'especially the case in cold and moist situations where rank vegetation prevails, and is the reason why we are very cautiously 'admitting a little grazing in such places. Pure forests of blue 'pine also are peculiarly liable to injury and even destruction by 'insect pests, and the artificial intermixture of deodar with this 'pine would be a very good measure."

In our May number, at page 178, we inserted a note asking for information about what became of the quantities of seed of *Albizzia lophantha* which have been obtained from Australia for the Punjab Forest Department. The following extract practically gives the answer to our enquiries, and we hope it will shew Baron von Mueller that the seed has not been wasted :—

"By far the most interesting and perhaps the most important 'experiment is that with the European *Robinia Pseudo-Acacia* and 'Australian *Albizzia lophantha.* I have previously explained that 'I did not particularly care to spend much money or trouble on 'the introduction of these species in the higher hills, although they 'are being supplied to those places in small quantities. But I am 'very desirous of finding some species which will assist us in 'stocking up our forests in the low hills up to 4,000 feet. 'Previous experiments had been decidedly unsatisfactory in results, 'but I was convinced that the plants had, in most places where 'they had been tried, not received fair play.

'Proper trouble was not taken to cultivate them, and the 'nursery treatment was certainly neglected. In the situations I 'particularly desired success, nothing was done beyond sowing the seed in indifferently prepared nurseries and then abandoning it. For this year, however, I am glad to report a very decided improvement both in the interest and care taken, and in the result.

'In the Pabbi I found last January a few plants still alive in the nursery in which they had been sown in the previous rains: they had never been re-bedded or cared for in the least, and consequently had very long tap roots. The weather being favourable I had them re-bedded at once before me, only 3 out of 400 *Robinias* and 20 out of 706 *Albizzias* succumbing under the operation. They made such progress in the new beds that at the end of February they again required re-bedding; unfortunately my orders had again been neglected, they had been steadily watered when they did not require water, and were far too delicate for forest plants and their numbers fell to 340 and 500. These are now all alive and well; and, notwithstanding mistakes, I am convinced that the nursery treatment of the two species, especially of the *Robinia*, is perfectly easy. The *Robinia* grows much faster than the *Albizzia*, and in June 1893 had reached the dimensions I had fixed for its being transplanted out. They were put out in pits 15 feet apart, and have now made remarkable progress in their final homes. All the 340 are alive and well. I consider these results very promising for the extension and success of the *Robinia* in the Pabbi."

The financial results of the year were as follows :—

	Forest year 12 months.	Financial year.
Receipts ...	8,20,988	8,12,632
Charges ...	6,52,044	6,56,265
Surplus ...	1,68,944	1,56,367

the results being very low. The Conservator remarks that the revenue will probably decrease, so that the surplus cannot be maintained in future; but in this the Government of India disagree.

The COORG Report has suffered in interest from the fact that the Deputy Conservator, Mr. G. H. Foster, died during April, 1893, and his successor did not join till after the close of the year. The chief subject discussed in it as well as in the Reviews by the Commissioner of Coorg and the Chief Commissioner is the improvement of fire protection works in which the late Mr. Foster took such an interest.

The financial results of the year were :—

	Forest year.	Financial year.
Receipts ..	1,85,529	1,80,676
Charges ...	70,407	73,091
Surplus .	1,15,122	1,07,585

Durability of Wooden Sleepers.

The last statement published by the Public Works Department shows the results of the experiments to test the durability of wooden railway sleepers up to the end of the year 1892.

On the Ajmere-Khandwa section of the Rajputana-Malwa Railway six miles of wooden sleepers were laid down in 1876. The results at the end of the year 1892, *viz.*, after 16 years, are as follows :—

Out of	2,054	Deodar	95	per cent.	are	still sound
„	6,585	Creosoted Pine	33	„	„	„
„	1,986	Kahoo (Terminalia Arjuna)	32	„	„	„
„	83	Sal	33	„	„	„
„	902	Anjan	41	„	„	„
„	689	Teak	29	„	„	„

On another section of this line, out of 13,042 creosoted pine sleepers laid down in 1880 only about 20 per cent. are still sound, and out of 450 deodar on the same section only 29 per cent. On the Rewari-Ferozpore section, of 1,166 deodar laid down in 1882, 68 per cent. are still sound, whereas of a small number of creosoted pine, 84 per cent. were removed after four years.

Again, in another part of the same section, out of 11,943 deodar laid down in 1884 only 74 have so far been removed, but the time is rather short for this result to be of much value.

On the North-Western Railway, out of 1,416 deodar laid down in 1877, 79 per cent. are still sound, after 15 years, whereas of 1,144 creosoted pine of the same experiment none now remain, the average age of this kind of sleeper at the time of removal being 13 years.

The results obtained on this Railway are, however, a little variable, as in another portion 957 Deodar sleepers laid down in 1878 were all removed in 13 years, whereas the creosoted pine seems to have fared better, as out of 382 only 193 had to be removed after 14 years ; the number of the latter in this case, however, is rather too small to affect the general results of the experiments which still remain as heretofore in favour of deodar.

On the Southern Mahratta Railway out of a small number of teak and creosoted pine laid down in 1880, 93 per cent. of the former and 60 per cent. of the latter are still sound. In another part of the same line out of 1,020 teak and 589 pine (creosoted) 91 per cent. and 55 per cent. respectively are still sound after 12 years.

On the Eastern Bengal Railway, in the experiment of 1877, out of 1,973 Sal, 59 per cent. are still sound, whereas of 1,923 creosoted pine only 9 per cent. still remain.

In another portion of the same line, Sal shows 73 per cent. still sound out of 2,006 laid down in 1879.

The other experiments on this line extend over shorter periods, but it may be noted that 57 of the 1,823 iron-wood sleepers laid down in 1884 had to be removed during the year 1892.

A. F. G.

V.—SHIKAR, &c.

Athletic Sports of the Imperial Forest School.

On Saturday last, the 13th of October, the annual sports of the Imperial Forest School came off on the Old Parade-ground. The Director of the School, Mr. J. S. Gamble, had, unfortunately, to go out into camp the week before, and so was unable to superintend the sports as has been his wont for the last three years. The course was laid out very prettily with flags by the school staff under the superintendence of the Deputy Director, Mr. Nisbet. The committee was composed of the school staff, the Forest Divisional Officers in Dehra and Mr. Reynolds, Superintendent of the Forest Surveys. The view from the Parade-ground, commanding as it does a complete panorama of Mussoorie, is always beautiful, and when the visitors arrived, as the evening drew on, the bold range of hills on which that favoured hill station rests formed a peculiarly suitable background to the Parade-ground and the line of well-wooded estates which bounds it on the northern side.

Tents were erected as usual for the reception of visitors, and a detachment of Municipal Police kept the enclosure which had been roped off around the tents free from the usual crowd who invariably collect when a *tamasha* of any kind takes place. The preliminary heats were run off early in the afternoon, and the finals of the different contests came off later when more spectators had arrived. Another year, it is probable that the heats will be run off during the previous week, and that the final contests only will be reserved for the day. This would be a decided improvement. The event of the afternoon was the performance of P. E. Plunkett in throwing the cricket ball; we think that the throw is a record for Northern India, if not for the whole of India. The ball was thrown against a light and somewhat variable wind, and the distance was accurately measured under the direct supervision of the committee. The distance thrown was 116 yards, 1 foot. None of the other performances call for special mention, the entries were not so numerous as usual, probably owing to a few of the students being decidedly better than the others. The half mile was a good race, and brought out fourteen competitors, the contest for the high jump was very keen. The list of winners is appended. No times were taken :—

100 *Yards' Flat Race.* (Open)

F. J. Langhorne	...	... 1
N. Chinniah	...	... 2
S. A. Wood	...	... 3

There were fourteen entries, but only seven men actually started, the race resulting in an easy win for Langhorne. Chinniah and Wood had a good tussle for second place.

Broad Jump. Open to the whole school. One prize for the best native student. 11 entries.

F. J. Langhorne, 16 ft. 7 in.

Best Native Student : N. Chinniah, 15 ft. 6 in.

Won easily, the winner was not at all pressed, or would have undoubtedly jumped better.

Hurdle Race—120 yards. Open to the whole school. 12 entries.

This race was run off in two heats, the first and second man in each heat running in the final.

F. J. Langhorne	...	... 1
S. A. Wood	...	... 2

Langhorne drew away at the first hurdle, and won by 10 yards. Chinniah, who had been running in a great many events, pressed Wood as far as the eighth hurdle, when the latter drew away and came in second.

Hurdle Race for Native Students only. 7 entries.

This was run off in two heats, the first two men in each heat running in the final. The results of both the heats were very close, and in the final a very good race resulted in favour of Kashi Ram.

Kashi Ram	...	... 1
N. Chinniah	...	... 2

Both men took the hurdles simultaneously, the winner drew away after the last hurdle and won by a yard.

Throwing the Cricket Ball. Open to the whole school. One prize for the best native student. 7 entries.

P. E. Plunkett, 116 yards, 1 foot.

Best native student ; N. Chinniah, 87 yards 1 foot.

A magnificent throw; W. Brewin, who was second, threw 93 yards, 1 foot.

100 *Yards' Flat Race for Native Students only.* 12 entries.

This was run off in two heats, the first two in each heat running in the final.

N. Chinniah	1
Amar Nath	2

A very close race, won by 1 foot.

High Jump. Open to the whole school. One prize for the best native student. 8 entries.

S. A. Wood, 5 ft., 1 in.

Best native student: Kashi Ram 4 ft., 8 in.

Graham, who was second, cleared 5 ft., but failed to jump 5 ft. 1 in.

100 *Yards' Flat Race for Forest Chaprassis.*

Amar Sing	1
Burhan-u-din	2
Pir Mahomed	3

Half Mile. Open to the whole school. 14 entries.

R. C. Farrell	1
Daya Ram.	2

Daya Ram followed by Kashi Ram forced the pace to begin with, and at half distance they were leading by 30 yards, the European students lying in a bunch behind. About 200 yards from home Farrell increased his pace and soon passed Kashi Ram, and about 80 yards from home caught Daya Ram and won a good race by 15 yards.

100 *Yards' Flat Race for Gurkha Riflemen.* 8 entries.

This was run in two heats and resulted as shown below:—

Tikaram Kuar	1
Nathu	2
Naik Parbal Gutung	3

The Tug-of-war brought the contests to a conclusion. The sides were Seniors *vs.* Juniors, and resulted in an easy win for the Seniors, which they ascribed to the muscle-forming properties of the hill tour made annually in the Jaunsar Forest Division in the hot weather. The prizes were distributed by Mrs. Garstin at 6 P. M., the names of the winners being called out by the Deputy Director. Plunkett, Langhorne, Chinniah and Pir Mahomed came in for the greatest share of applause. Cheers were then given for Mrs. Garstin, the ladies, the Deputy Director, and the Instructors; and then the proceedings terminated. The chief brunt of the work in the actual laying out of the course fell on Forest Ranger Birbal and his assistants, and he proved himself quite equal to the task.—*(Pioneer).*

VI.–EXTRACTS, NOTES AND QUERIES.

Woods used in India for the Construction of beer-barrels.

We have received the following extract from the Inspector-General of Forests :—Before proceeding to discuss the trade in beers and ales, it is necessary to say something about the construction of beer-barrels, etc. The barrels or casks used in the breweries of this country are almost without exception constructed of oak, and are either made up in India from rough staves imported from the Baltic, or imported in shook, *i.e.*, bundles from London, and re-made in this country. Several attempts have been made to utilise the indigenous timbers of this country for barrel-making, but the extensive and various forests of India have failed up to the present moment in producing a wood good enough to replace the English or European oak. Sal (*Shorea robusta*) has been tried with some success in the construction of vats. White cedar from the Malabar Coast makes a good looking vat, but its use is somewhat dangerous in consequence of the absorbent nature of the wood rendering it very liable to crust. The English oak would find a strong competition in the Indian ash and teak if the former could be got in larger quantity and the latter at cheaper rates. Deodar, and the wood of pines generally impart their resinous properties to the beer. The brewers of India are very anxious to find a wood which would successfully compete with the expensive and indispensable English oak, but hitherto the efforts to find such a timber have been unsuccessful. The valuable characteristics of oak are its freedom from knots, its density, durability and lightness. It is also non-absorbent, and thus not liable to impart its resin to the beer.

In some experiments tried with the wood of various oaks, as materials for beer-barrels, Messrs. E. Dyer & Co., of the Burma Brewery, found casks made from two varieties (*Quercus glauca* and *Quercus serrata*) useless, as the wood was too porous and the beer oozed. A third species (*Quercus semiserrata*) is reported to have good, straight-grained wood, free of knots, very nearly resembling imported oak, and the casks made out of it retained the beer well. Unfortunately the difficulties in the way of the transport render its price prohibitive. But if the economic value of the tree comes to be known, and its cultivation on a wide scale is undertaken in suitable localities, the gradual extension and improvement of internal communications may in time bring the wood into the market.

Quercus semiserrata (*thitkya*, Burma,) is an evergreen tree, found on the plains of Assam and Cachar and on the Garo and Khasia Hills, up an elevation of 3,000 feet. It occurs also in Burma from Pegu to Tenasserim.—(*Indian Agriculturist, October 1st*, 1894.)

On the Utilisation of Waste Produce of Forest and Woodlands.

The successful culture of forest trees is a matter of much importance to landed proprietors, although at the same time it is very important to be able to turn the trees to the best account after they have attained the years of maturity, so that root, stem, and branch may be utilised to the best advantage and nothing lost. Tree roots are often left in the ground to rot, but I have found the roots of many species capable of being turned to account for profit in several ways. The roots of the larch, elm and spruce when of proper size and shape. are valuable for making knees, for boat-building and other purposes in rural economy ; the price varies considerably according to size, shape, and quality, but as a general rule I have found them realize more than double the price of the wood of the stem. The most expeditious way of extracting and preparing them in the forest is to cut the roots at the proper distance from the base of the stem, than, by attaching a rope to the top of the tree, and taking advantage of the leverage of the stem, the tree can be pulled down and the roots torn up at a trifling cost in comparison with that of felling the tree first and then grubbing up the root after. The stem of the tree should then be cut off with a saw, about 18 in. or 2 ft. from the base of the root, in order to form the shape of the knee. I have used the small surface roots of the common spruce and birch for weaving rough baskets, creels, and hampers ; the best roots for this purpose are generally to be fonnd in mossy ground. where they run along the surface and are often of great length, fine in texture, and easily extracted. In some soils and situations the roots of the common ash and hazel can be turned to good account by the cabinet-maker and others for veneering and fancy work of different kinds. The roots of both species often exhibit great variety in texture and colour ; sometimes they become stained of a blackish hue mixed with red, and as they both take on a fine polish, they are considered by some to be little inferior to that of ebony. Although the roots of the fir tribe of trees are often left in the ground to rot and decay, yet they are capable of being utilised for firewood ; I have found the roots of the Scotch Fir to be the best for this purpose, as the fibrous texture of the roots is generally pretty well impregnated with resin, which enhances their value very much in kindling fire. When the roots are dug up they are cut with an axe into fragments of about 11 in. in length ; they are then tied into bundles of from 8 to 10 in. in diameter and sold at the rate of one penny, and sometimes two-pence, per bundle. In some parts of the country there are parties who make a trade of preparing firewood in this way, and thus act the part of a middleman between the landlord and consumer. These middlemen occasionally pay so much for the privilege of extracting the roots, while at other times they get them free of charge, as the landlord in many cases looks upon it as an advantage in his favour to get rid of the roots as a preliminary step in preparing the ground for replanting. It should be explained here that these roots and stumps when left in the ground are used by the pine beetle and pine weevil for breeding purposes, hence the proprietor's advantage in getting rid of them. Dead trees and fir wood that cannot be used for any better purpose are often sold to these middlemen, who cut and split them up into small pieces some 6 or 8 in long, tie them into bundles about 6 in. in diameter and sell them at one halfpenny each or three for a penny. Of late, however, a new market has sprung up in this country for wood of young growth and inferior quality for the making of paper. The wood of whatever species of tree must all be white in colour, red heartwood is unsuitable and is not used, which is so far in favour of the vendor as it can generally be utilised in many ways to better advantage. In preparing the wood for this purpose, the outer and inner bark or skin has to be removed, and the wood cut into lengths of from 3 to 6 ft. In a letter of inquiry which I have just received, the writer says: "I can take any quantity you can supply up to 20,000 tons at 20s. per ton, delivered at Barrow." The bark can be removed from the wood with great facility in early summer and when birch, larch, Spanish chestnut, and oak are used, the bark had better be dried in a careful manner, and sold to the best advantage for tanning purposes. The price of these barks varies considerably in different years, according to supply, demand, and quality. The lowest price which I have received for larch bark was 25s. per ton, and the highest for that of oak, which of late years averaged from four to six pounds per ton. The bark, chips of wood, young growth of other species of trees that cannot be utilised for other purposes, should be used for fuel, or converted into manure by burning, when the ashes can then be used for top-dressing grass lawns and other purposes. Wood ashes contain all the required elements of plant-nutrition except nitrogen. 100 lbs. of potash, 3¼ lbs. of soda, 67 lbs of lime and magnesia, and 5½ lbs. of phosphoric acid. When used to improve exhausted soil in fruit-tree culture, wood ashes has no equal, at any rate the writer has used it for many years with the most happy results, as it never produces canker or any other disease at the roots, and improves the growth and health of the trees immensely. The common birch is not considered by many to be a very profitable tree, yet it has some peculiar merits which should not be overlooked. In the first place it not only grows, but also reproduces itself on cold, boggy ground in wet, hollow places, as well as on poor, hard, inorganic matter among the chinks and fissures of rock on bare, exposed situations where few other trees will grow or attain anything like the size of useful timber. When thinning natural plantations of this class I sold the thinnings at the rate of 12s. 6d. per ton. All shapes and sizes were taken, from branches half-inch in diameter up to any size, and where possible, the bark was used for tanning purposes. Then, if we deduct 1s. 6d. per ton for cutting and preparing the wood, and 1s. per ton for cartage to the depôt, we have a net balance of 10s. per ton in favour of the proprietor for his timber. The charge made of 1s. 6d. per ton likewise covers the expense of thinning. The top branches and twigs were utilised for making besoms, thatching shelter-sheds for cattle, erecting screen and shelter fences, and for fuel. In many parts of the Highlands of Scotland, as well as some parts of Ireland, the birch is looked upon as the husbandman's tree ; the wood is used for the making of all kinds of agricultural implements, as well as household furniture, and the roots and branches for fuel and other purposes, so that every part of the tree is turned to good account. In some parts of the country the wood is likewise used for smoking fish and hams, as it is considered to impart an agreeable flavor which is relished and esteemed by many. The bark of the birch often commands a ready sale among fishermen, and when it can be had is preferred before that of any other tree for tanning their nets and cordage, as it is not only lasting, but also imparts a soft elastic finish to the fibre of the cordage, which is considered an advantage. When the bark is well saved it often realises £5 per ton, or more, according to quality. The common alder is another hardy, thrifty tree that can be turned to good account. It grows and attains a profitable size of timber on wet, marshy ground that cannot be thoroughly drained, and when cutting down the trees in such situations the writer sold all shapes and sizes of the wood from 6 in. in diameter and upwards at 20s. per ton, and sizes from 6 in. to 3½ in. in diameter at 8s. per ton, the purchaser to take delivery at his own expense. The branches and twigs were sold at 1s. per load, buyers to collect and remove the stuff at their own expense. These were used for firewood and shelter-fences about farms and other places. This tree is not planted to the extent which its merits deserve, at any rate the writer could never supply the wood to meet all demands at the the above prices, which he found on the whole to be very remunerative. The tree is very tenacious of life, and of rapid growth ; the roots left in the ground produce suckers, which form excellent coppice-wood, which after a growth of about eight years, can be profitably cut for making hurdles, crets, &c.; while the young twigs and catkins gathered and prepared in spring produce an excellent dye, the latter of a greenish, and the former of a light brown colour.

The top and lop of the willow and poplar tribe of trees being of a soft, white colour is adapted for paper-making and many other purposes in rural economy where extreme lightness is requisite. Branches of a suitable size are made into sheep-hurdles, while small flexible twigs can be used for making rough creels and hampers. In some parts of the country the branches are also used in the formation of shelter fences, by planting them about 18 in. deep in the ground, and some 10 or 12 in. apart.

Here they soon emit roots, and by a little care and attention in training and pruning the young growth, a substantial, lasting fence can be formed at a trifling cost. I have also found the branches capable of being used as piles along the banks of rivers to form a bulwark to prevent the water during a spate from encroaching and washing away the earth along the margin. The seeds of the aspen poplar (*P. tremula*) are often spread by the wind throughout plantations, where they vegetate and form young growth among hardy natural grasses and other plants that are capable of being utilised for making hay. When such is the case, my practice has been to cut the whole together and have it properly dried, when it is then built into a stack, mixing a little salt with the stuff as the work of building proceeds, by which means I found the poplar shoots to be eaten during winter with avidity by sheep, cattle, horse , and deer, so that in this respect it has proved to be a valuable forage plant. In many parts of Scotland, England, and Ireland the trees and surface of the ground are to a considerable extent clad with ivy, and, as it is one of the best forage plants with which the writer is acquainted, it is astonishing that it has not been utilised to a larger extent for feeding purposes. Many years ago I observed that sheep and deer preferred ivy to turnips or grass, from which circumstance my practice has been to utilise all ivy thinnings and clippings, as well as that attached to trees, for feeding these animals occasionally when it could be had during winter. They eat the leaves and bark of the stems with such a relish that I believe it to be a wholesome, nutritious tonic.

When thinning young Scotch fir plantations I have occasionally turned the branches and young growth to good account for feeding hares, rabbits, and deer in the vicinity of newly-planted plantations of hard frost and snow. Such plantations often suffer serious damage by these vermin peeling the stems and cutting over the top growth of the plants. Under such conditions my plan has been to cart a quantity of these green branches and have them spread out on the surface of the ground here and there around the margin of the plantation, where they immediately attracted the attention of the animals, who delight to eat the leaves, twigs, and bark at this particular season of the year. The branches of the ash, oak, holly, and laburnum, when they can be had, may also be utilised with advantage for the same purpose. By this means the animals are provided with food more to their liking than the young plants, and if the supply is kept up until such time as the storm breaks up, the damage to a large extent is past, and the plants safe.

These peeled branches can then be sold for firewood, and sometimes for the making of fancy rustic work, and realise about 1s. per load, and occasionally more, according to quality. Scotch fir branches, however, of young growth, are often wanted for rustic work with the bark attached, and in this case I have made the purchaser collect and remove the stuff from the plantations at his own expense, charging him at the same rate per load as the former. In some parts of the country where coals are scarce and dear the top and lop of Scotch fir and other trees can be utilised with advantage for fuel. As, for example, during the time that the new Castle was building at Balmoral, which covered a period of fully six years. from 1853 till 1859, the writer supplied the tradesmen's bothies, about 20 in number, with fir branches for firing, and as coals were often as high in price as 25s and 30s. per ton, the saving effected here was considerable. Another important advantage in this case was that the forest was kept clean and tidy at a trifling cost. All twigs and stuff of small size were collected and burned on the spot, the ashes spread out upon the surface, and the bare spots occasioned by the fires sown with a mixture of hardy grass-seeds suitable for such situations, which soon covered the surface with nutritious grass which proved valuable as pasture for deer and cattle. By this system of management everything was turned to good account; and besides, by the removal of dead wood and branches, which harbour insect pests destructive to pinetree growth, their numbers were kept within bounds to such an extent that very little damage was done to the healthy development of the trees. In some of the extensive peat-bogs in Ireland and other places fir branches have been used to a pretty large extent in the formation of roads. The branches are laid in a regular, uniform manner on the surface of the bog as a base for harder material, and from the well-known antiseptic properties of peat the wood is kept for an indefinite length of time almost in a perfect state of preservation. In the course of carrying out estate improvements the writer has used the branches for this purpose extensively, and found them to be quite free of rot after being underground for a period of thirty years. The cones of many of the coniferous tribe of trees are often allowed to go to waste for want of a little care and attention on the part of the cultivator, whereas by a little painstaking they may be turned to good account as a source of profit. The cones of the native Scotch fir in particular should be collected in the natural forest, and the seed· for raising young plants, as the trees are not only harder, but the wood of superior quality to that of trees of the same species raised from seeds of the foreign origin. On the other hand, the cones of the larch had better be collected in Ireland, where the trees are never affected with blotch, ulceration, or blister. Coniferous trees of recent introduction make remarkable progress in that country, and are generally very prolific in the production of seed.

In the year 1861-62 the writer sold cones of *Picea Nobilis* at one guinea each. Of course the cones were carefully impregnated with male pollen to ensure the fertility of the seed. This important branch of arboriculture is both interesting and instructive, and shows what can be done in utilising the seed for the raising of young trees as a source of ornament, profit, and utility.

Although the seed of many species of deciduous trees are often allowed to fall to the ground or be blown away by the wind and lost, yet, in many cases, when they are thoroughly matured in autumn, they can with a little care and attention be utilised for the raising of young plants, and some few species, such as the beech, oak and chestnut, produce fruit that is relished by pigs, sheep, and deer, while the fruit of the walnut is relished by many people as a nutritious article of diet. The top branches of hardwood trees, when of suitable size and shape, are often in demand for pea-stakes and the formation of rustic fences, and are often sold at rates ranging from 2s. 6d. to 5s. per load, according to quality and the cost of transit. Peeled oak branches, however, that can be used for building rustic bridges, seats, and various shapes and forms of ornamental fences and fancy work, realise a higher price than that indicated. The inferior timber of beech trees is used for smoking different species of fish, and such pieces as are free of rot or other blemish are extensively used for making toys, stocks for carpenters' tools, and a variety of other purposes where cheap timber is used. Beech and hornbean timber are both esteemed in particular for firewood, and the charcoal produced from the wood of both species is considered to be of a very superior quality. In working up the top branches of hardwood trees to the best advantage all pieces that are pretty straight and 3½ inches in diameter can be sold for mining purposes at rates ranging from 7s. 6d. to 10s. per ton, purchaser to take delivery at his own expense. The tops of hardwood as well as fir trees can often be turned to good account for fencing-posts. Sometimes they are in demand in the round state, but very often are wanted cut to the following dimensions :—6′×7″×3″, or 6′ × 6″ ×4″ ; when prepared in this way I generally sold them at 10d. per cubic foot, which gave a favourable and profitable return to the proprietor. The same class of timber can often be utilised for halftree-rafters for roofing sheds. These are prepared by cutting off a slab along the side of the piece, then by turning it over to rest on the flat side thus prepared, it is cut with the saw right along the centre into two halves, so that each piece of timber forms a pair of rafters—hence the name of halftree-rafters. Small pieces of oak, elm, ash, and sycamore may likewise be cut into staves and headings for casks, and are generally in demand ¾-inch thick, and the length according to specification. Concrete frames are occassionally wanted by builders 18 inches long and 1 inch square. I have generally cut these from fragments of Scotch and spruce fir trees.

In cutting up wood at saw-mills it is a matter of much importance on the score of thrift and economy to use thin saws. Wood merchants who try to make the most of the wood are so well aware of the utility of using thin saws that they seldom use them thicker than No. 14 and 15 by the wire gauge. Saws used for slabbing and cutting up rough inferior timber, as well as cross-cuts, may be No. 12 and 13 by the wire gauge. The reason for using thin saws is of a twofold nature. In the first place, it takes less mechanical power to drive the machinery and saws, and in the second place there is less waste of timber. In cases where steam power is used the sawdust should be used as fuel for heating the boilers, but if not wanted for such a purpose it may be sold to the best advantage, and in large towns is generally sold by dealers at from *5d.* to *6d.* per bag. All pieces and fragments of hardwood trees unsuitable for any other purpose, had better be converted into charcoal, and in doing so its quality is greatly improved by the removal of the bark previous to charring. This applies in particular to different species of chestnut, limetree, and elm. Some species of hardwood trees occasionally produce valuable burrwood here and there on the stems and branches. These burrs, as they are called, consist of gnarled woody protuberances, finely twisted and knotted, and when cut up they are found in the majority of cases to be richly veined, which enhances their value very much when used for veneering and other ornamental purposes. The trees which are most prolific in producing these burrs are the birch, elm, oak, alder, and ash, and in dressing and preparing these trees for sale, the burrs are often cut off with the axe and allowed to go to waste, whereas in many cases they are the most valuable part of the tree. In order to make the most of this class of wood, the bark should be carefully removed in early summer, by which means the carpenter or cabinet-maker will be better enabled to form a correct estimate of its true value, and cut it out himself, or give directions how it is to be cut up to the best advantage for his requirements. Thoroughly decomposed leaves of deciduous trees make an excellent and valuable manure, and as it is beneficial to a large extent in promoting root growth, it can be used with advantage at the time of planting out ornamental trees and other valuable plants to give them a good start and prevent failure. The only risk which I have ever observed in using leaf-mould for such a purpose was in cases where chips and fragments of wood had been gathered along with the leaves, and as these often contain the spores of fungi they are apt to become active when placed below the surface, and thus impregnate the roots and kill the tree. In order to prevent this state of things, all twigs and chips of wood should be separated from the leaves before placing them in the depôt to rot. Leaf-mould makes an excellent top-dressing for grass lawns and for restoring exhausted soil to fertility, therefore it should be utilised to the best advantage to prevent waste.

(OLD FORESTER.—*In the Timber Trades Journal.*)

Message from Monsieur C. Broillard to French-trained Forest Officers.

About the beginning of this year we received from Monsieur C. Broillard, formerly Professor at the Forest School at Nancy, then Conservator at Dijon, and now in retirement Editor of the *Revue des Eaux et Forêts*, a copy of his book 'Le traitement des bois en France,' which was duly reviewed in our pages. In reply to a letter of ours thanking him for it and for the inscription which it bore "to the English-French Foresters of India, with kindly remembrance," M. Broillard writes "Je garde avec beaucoup de satisfaction la belle coupe que les pupilles Anglais de l'Inde m'ont envoce en 1881, et je vous prie de leur témoigner á l'occasion mes affectueux sentiments."

VII.—TIMBER & PRODUCE TRADE.

The Teak Market.

Messrs. Hoar and Brown report:—

	Timber. loads.	Planks. loads.	Blocks. loads.	Total. loads.
Stock August 1st, 1894	4,459	2,011	77	6,547
Landings	589	246	...	835
	5,048	2,257	77	7,382
Deliveries	494	212	...	706
Stock August 31st, 1894	4,554	2,045	77	6,676

The stock of timber has increased slightly this month, the figures at the present time showing 4,554 loads, being 543 loads less than the quantity held at the end of June.

Arrivals have not been so numerous in consequence of cargoes, which were expected to discharge here for purposes of selection, being now ordered direct to their destination.

Considering the limited home demand among carriage builders, &c., coupled with the scarcity of speculation, it is not regretted that imports have fallen off. However, prices still remain as they were for first-class wood, and the usual low figures are being quoted for second and third-class goods.

The market may still be described as flat, although the outlook is more promising.

Business in planks is fairly brisk with low priced parcels, the figures accepted by shippers having lately beaten record, but it is hoped the advance in rupee paper may cause a steadier market. Indications of this are already observed among shippers of later parcels, who are now asking an advance upon the earlier shipments of similar qualities held by the dealers. It is probable the value of planks may improve, provided always the importations are limited. Stocks remain practically the same.

Messrs. Denny, Mott, and Dixon report deliveries from the docks in London last month 716 loads, as against 1,264 loads for the corresponding month last year, and of this month's restricted delivery the majority was for export, showing even increased apathy in the general home demand.

The relation of supply to demand has altered but little since our last advices, and the landed stocks of logs, although considerably below the average at the time of year, are ample to meet all likely need that can be foreseen at present. Of planks, the visible quantity is apparently excessive, but as a large proportion of the sawn stuff sent by ill-advised shippers is quite unsaleable in this market, the supply of really good marketable planks is not actually too large should an average autumn demand spring up. In the floating cargo department there have been more sales for speculation than of late, although the prices reported can hardly cover the present import cost. There seems, however, no room left for economising in the direction of cost and freight, both these factors being at almost the lowest point yet touched, and saw-millers in Burmah and shipowners are alike refusing further to cut their prices and freights. In respect also to the difficult question as to the probable course of the rupee-exchange, we are inclined to agree with those experts who are of opinion that it has touched its lowest point, and that the recovery already shown during the past fortnight will be maintained for some time to come.

Churchill and Sim's Circular.

November 4th, 1894.

EAST INDIA TEAK.—The deliveries for the first three quarters of this year amount to 8,471 loads against 10,148 loads for the same period of 1893, and for September this year to 717 loads as compared with 1,385 loads in September, 1893. The figures reflect pretty accurately the dulness of the demand for general purposes. The prices are steady at a low level both for landed and floating stock. The visible supply of the latter continues amply sufficient for probable requirements.

RED-WOOD.—The stock is small, but demand very quiet.

SATINWOOD.—Finely figured logs would sell well, but there is very little demand for plain wood.

EBONY.—Large, sound, well-grown logs, in small parcels, would realize very fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superficial	6d.	to	12d.
Rosewood	,, ton	£5.	to	£8.
Ebony	,, ton	£6.	to	£8

MARKET RATES OF PRODUCTS.

Tropical Agriculturist, November, 1894.

Cardamoms	per lb.	2s.	to	2s. 6d.
Croton seeds	per cwt.	20s.	to	27s. 6d.
Cutch	,,	20s.	to	32s.
Gum Arabic, Madras	,,	15s.	to	30s.
Gum Kino	,,	£15	to	£18
Indian Rubber, Assam,	per lb.	1s. 7d.	to	1s. 10d.
,, Burma	,,	1s. 7d.	to	2s.
Myrabolams, Bombay,	per cwt.	7s. 6d.	to	9s. 3d.
,, Jubbulpore	,,	6s. 3d.	to	7s.
,, Godavari	,,	6s.	to	6s. 9d.
Nux Vomica, good	,,	6s.	to	10s.
Oil Lemon grass	per lb,	1¾d.		
Orchella, Ceylon	per ton	15s.	to	22s.
Redwood	,,	£3. 10s.	to	£4
Sandalwood, logs	,,	£35	to	£55
,, chips	,,	£9	to	£30
Seed lac	,	30s.	to	90s.
Tamarinds	,,	8s.	to	9s.

THE
INDIAN FORESTER.

Vol. XX.] December, 1894. [No. 12

Visit to the Culbin Sands, Morayshire, Scotland.

The Culbin sands consist of a series of sand hills or dunes and form probably the greatest extent of drifting sands on the coast of Great Britain, the total length being about 12 miles, with a breadth ranging from one to three miles.

They cover an area of about 9,000 acres and are situated between the town of Nairn and the mouth of the Findhorn river in the counties of Nairn and Elgin or Morayshire.

The physical features and climate of this part of Scotland may be briefly described as follows :—the country is picturesquely undulating and consists of a series of low hills and stretches of flat country, the mixture of forest, cultivation, and moorland forming a very pleasant combination.

The geological features consist, in the Northern parts, of a mixture of sand and gravel belonging to recent deposit, whereas in the South, the old red sandstone is well developed.

A large proportion of these counties, comprising probably about one third of the whole area, is covered with fine plantations of Scotch fir, larch, beech etc.; and some well grown timber was seen in the Altyre woods and Darnway Forest, the former belonging to Sir W. Gordon-Cumming and the latter to the Earl of Moray.

It was satisfactory to note that little or no damage to these fine woods had been caused by the great storm of November 1893, which, in other parts of Scotland, such as in Perthshire, Inverness and Sutherlandshire, swept clean whole hill sides of flourishing plantations.

These woods generally occupy the low hills and gently sloping grounds, whereas nearly all the level intermediate ground is highly cultivated and productive, especially when the season is a wet one, fine crops of barley, corn, turnips, potatoes and a little wheat.

There is a limited area of moorland devoted to the pasturing of sheep, and preservation of grouse, but the moors in these two counties are not extensive.

The principal river in this part of the country is the Findhorn, which rises in the county of Inverness and after a course of about 60 miles falls into the sea north of Forres to the east of the Culbin Sands. There are a few lochs or lakes scattered over these counties, but owing to the porous nature of the soil none are of great extent.

The climate of Nairn and Moray is said to be the most genial in Scotland, which may be attributed to the following favourable causes. The extreme smallness of the rainfall, the average being only 22 inches, as compared with 32 inches at Brighton and 48 inches at Penzance. The effect of the Gulf Stream, which is supposed to sweep round into the Moray Firth and thus exercises a considerable influence on the equability of the climate. The sandy, porous nature of the soil absorbs the rain water in a very rapid manner so that damp and fogs so prevalent in other parts of Scotland, are of much less frequency in this part of the country. Another important circumstance also tends to ameliorate the climate of this part of Scotland, *viz.*, the shelter afforded to the west and south of the ranges of Ben More and Ben Wyvis, which have the effect of drying the prevailing west winds by depriving them of their moisture. All these favourable conditions combine to render this locality one of the most sunny parts of North Britain and the counties of Nairn and Moray are said to enjoy forty more sunshiny days than any other part of Scotland.

Another important result of the favourable nature of the climate is that the crops ripen very early, considering the latitude, and are often harvested at the same time as those in most parts of the south of Scotland, the drying nature of the soil, which in this case is considered prejudical to agricultural interests, is, to a certain extent, counterbalanced by the presence of boulders and gravel mixed with the sand, which have the effect of checking too rapid evaporation, and retaining the moisture. The climate of these counties is also most favourable for the cultivation of all kinds of European fruit trees, and even peaches ripen easily in the open air if grown on a brick wall.

As might be expected, the dry nature of the climate exercises a most remarkable effect on the preservation of buildings and this is specially noticeable in the case of the Findhorn bridge which, though erected in the year 1832, still looks as if it had been constructed only 10 or 12 years ago.

But to return to the Culbin sands and the causes which have led to the formation of these extensive dunes. Considerable diversity of opinion exists amongst geologists. The following theories, however, may be assumed to be the probable causes which have led to their formation. That large quantities of sand have, during recent centuries, been excavated by the action of the tidal waves from various parts of the Sutherland and Rosshire coasts and carried by the currents and waves towards the head of the Moray Firth and deposited on the shore near Nairn. It also seems certain that the area now occupied by the Culbin sands has gradually become depressed probably from about the middle of the sixteenth century, this theory being supported by the fact that, at various places along the neighbouring coasts, notably at Lossymouth, several sea beaches are discernable, some of them now situated at a considerable height above high water mark. It may therefore be assumed that, in accordance with a well known volcanic theory, the elevation of the coasts in the vicinity has possibly led to the depression of the area now occupied by the Culbin sands. In any case, previous to the year 1650 the site of the Culbin sands constituted the important Baronry of Culbin, which was then considered a most fertile tract and was called the granary of Morayshire.

From that period, however, the drifting sands continued to make steady progress in its movement along the coast in an eastern direction, till about the year 1700 they had completely swallowed up the greater part of this fertile tract.

It is known that many small crofts or hamlets, including a church, were buried in the drifting sand and that no traces of them now exist.

So sudden, on some occasions, was the advance of the sand-drift, especially during the prevalence of western gales, that fine crops of corn, &c., were often covered up in a single night and on one remarkable occasion a ship-load of smuggled brandy was hopelessly buried, to the great chagrin of the expectant recipients, while thirsty descendants continue to search for the missing liquor up to the present day. The eastern movement of the sand has also had the effect of modifying the course of the Findhorn river, which at one time entered the sea about three miles further to the west, and at the time an extensive area was submerged owing to the accumulation of sand at the mouth of the river.

About the year 1690 the important fishing village of Findhorn was buried beneath the drifting sand and the site had to be changed one and a quarter miles further to the east, where even now, its existence is considered extremely precarious. This village was at one time one of the most important fishing centres in the North of Scotland, but owing to the accumulation of sand in the estuary of the Findhorn river, even small fishing boats cannot, without difficulty, now enter, and the fishing trade of this village has, therefore, been completely ruined.

The action of the drifting sand has, however, been considerably modified by the floods of the Findhorn river, which is one of the most rapid streams in Scotland and liable to violent and sudden floods. Of these disasters, the most important was the great flood of 1829, a description of which, even though it may possibly be considered ancient history, may interest the readers of the *Forester.*

This great inundation, which forms one of the most appalling events of this part of Scotland during the present century, took place on the 4th August 1829 and is still remembered by the oldest inhabitants with considerable awe. The season had been an unusually dry one, when suddenly, on the 2nd and 3rd August torrents of rain, accompanied, it is said, by several waterspouts, fell over the catchment area of the Findhorn river on the high grounds in the county of Inverness

The result was that the river Findhorn rose to an unprecedented height and at one place, near its juncture with the Divie, it reached 40 feet above its usual flood level. The flood did immense damage to the river banks and neighbourhood and great numbers of trees and cattle, also crops and nearly all the bridges on the river were swept away ; a considerable area of country in the lower course of the river near Forres was submerged and fishing smacks sailed about freely in the work of rescuing the inhabitants of the villages and hamlets. The total damage done by the flood was immense, and was estimated at £20,000.

The present condition and formation of the Culbin sand hills may be described as follows. As already stated, the original area covered up appears to have been about 9,000 acres, but this has now been reduced by means of plantation and other reclamation works to about 5,000 acres. The appearance of this barren and shifting area is desolate and bleak in the extreme but the drearyness of the scene is somewhat relieved by occasional glimpses of the sea and the picturesque landscape stretching towards the south. The formation of these dunes has been effected in the usual manner and may be described as follows. The loose sand, after being deposited by the tides near Nairn, is slowly driven along by the July winds up the gentle inclines of the sand hills and forms long slopes, but on the eastern sides it falls over and forms steep scarps, as is usually the case with drifting sands. The sand hills therefore travel along the coast in parallel ridges in an easterly direction, the highest elevation attained being 100 feet above sea level.

The sand is extremely fine, but here and there, apparently along the old course of the Findhorn river, there are some beds of gravel and these hollows are generally filled with water during floods or high tides. Underneath the sand in some places, there is apparently a bed of good soil, which probably formed the cultivated area before it was covered up, about three hundred years ago. There also seems to be a certain amount of moisture lower down, due to percolation from the sea or Findhorn river and these conditions tend to demonstrate that planting operations in most places would not be attended with so much difficulty as might be expected. The vegetation of the unreclaimed and shifting portion of the Culbin sands is extremely scanty and consists mainly of tufts of

Bent grass (*Psamma arenaria*) and a few scattered bushes of gorse and broom, but considerable areas are altogether barren.

The wire-like roots of the Bent grass are eminently suited for fixing the drifting sands, but it is stated that the binding action of this grass was for many years interfered with by the neighbouring villagers who ruthlessly pulled it up for the purpose of thatching their houses, thus leaving the sand to drift about at the mercy of the winds. This pernicious practice was, however, put a stop to by a special Act of Parliament which is apparently still in force. It is most satisfactory to note that there is no grazing of cattle or browsing of flocks in these sand hills, which greatly facilitates the planting operations.

Rabbits appear to be the only quadrupeds which inhabit this sandy area and an interesting collection of the principal birds found on this coast, besides other sand relics, such as portions of agricultural instruments, &c., are to be seen at the Falconer Museum at Forres, where also may be observed a spendid collection of extinct monster fossils from the Siwalik hills, N. W. P., India.

The site occupied of the Culbin sands is comprised in the private estates of Brodie Moy, Kincorth and Burtness, so that State interference in the reboisement work of the sand hills would have presented considerable difficulty and does not seem to have been desirable. Up to the present, therefore, the work has been left entirely in the hands of the neighbouring proprietors who, it is satisfactory to note, have done a good deal towards checking their inroads, though much more doubtless might have been done.

The result is that a considerable area, probably amounting to about 5,000 acres has been planted up, principally on the south and west sides of the sand hills.

These planting operations were first commenced about fifty years ago by Mr. Grant of Kincorth and the success of this work was such that he obtained the Highland Agricultural Society's gold medal as a special mark of their approbation.

This planting, it may be observed, was started on pure sand, the species used being mainly Scotch fir and birch, the former being planted on the pure sand and the latter in the low lands and hollows between the hills.

The Kincorth platations are situated on the south side of the sands about two miles from the sea and extend for about a mile along the border of that estate, the average breadth being about a quarter of a mile.

The trees have evidently been planted close together and have been done fairly well, the average height being about 40 feet and girth from 3 to 4 feet. The ground below the trees is now well covered with grass, heather and some humus which seem to have effectually checked the drifting of the surface sand, whereas the trees themselves form an effective barrier against the progress of the new sea sand towards the neighbouring cultivated lands. Following the example of Mr. Grant, the neighbouring proprietors of Brodie and Moy also started plantations further to the west, which now cover an area of about 3,000 acres, and extend from the edge of the cultivated area to the sea shore, and as might have been expected, have effectively stopped the drifting sand in that direction.

Some extensive planting operations have been undertaken during the last 20 years by Major Chedwick of Findhorn, in that part of the sands called Burtness and situated on the left bank of the Findhorn river, at the east end.

These plantations now cover an area of about 100 acres and are most creditable to the energy and preseverance of the proprietor

It may be noted, however, that the main object of these operations has apparently been to form an immense rabbit warren and the difficulty of rearing the young trees along with the rabbits may easily be imagined.

Every new patch of plantation has consequently had to be fenced with wire netting for protection from the rabbits till the trees were about 10 years old, by which time, owing to the hardnesse of the bark, they are considered protected from serious damage.

The system here adopted when any new area is to be operated upon is to cover the loose drifting sand, with high brushwood, grass, &c., which in a year or two decays and forms a slight vegetable covering, after which the young plants of scotch fir, spruce, larch, birch, &c., are planted out.

Considerable areas were also observed, sown with furze, broom and various kinds of sand-binding grasses; also the planting of the indiginous bent grass is undertaken with marked success.

The result of these operations is that, in addition to a thriving rabbit warren and pheasant preserve, the sand drifts towards the upper portion of the Findhorn bay have been stopped, or at least much modified.

It is also stated that before Major Cheswick's plantations were started, the loose sand used to be transported by the westerly wind right across the Findhorn bay and deposited on the fertile fields of the ancient village of Kinloss, but now, this state of affairs has completely ceased. Eastward, however, towards the mouth of the Findhorn river, the drifting sand continues to advance unchecked, and if much more extensive operations are not undertaken to arrest its progress, the estuary will soon become choked up and the village of Findhorn again buried or swept away by the first great flood of the Findhorn river, combined with the action of the drifting sand on the river bed.

E. Mc. A. M.

Disease of Cocoanut Trees in Travancore.

Under the above heading a query appeared in the *Indian Forester* for September last. As no answer appeared in your October issue, I venture to give the following attempt at a solution of the question, though it only concerns one of the reasons advanced, *i. e.* insect attacks. Scientifically, I should think any one of three theories, insect, fungus, and exuberance of sap, might account for the phenomenon. I should not care to express an opinion about the 'falling star' explanation.

Your correspondent states that they are convinced it is not the work of *Oryctes Rhinocerus* or of *Batocera rabus* (a Longicorn). I think, however, that these are probably not the only insects to be taken into account. There are some seven insects known to prey on the Cocoanut, the particular insect present depending on the geographical position of the tree ; of these, two, *Rhynchophorus ferrugineus* & *B. rabus* are known for their tunnelling propensities. They are both Coleoptera *Oryctes Rhinocerus* and *Gangara thyrsis* (a lepidoptera) are injurious to the leaves. I conclude the damage was not due to the extra abundance of the larvæ of the latter, as its presence would have been noticed. From what your correspondent states, the above insects, therefore, may be left out of account. The fifth insect is another weevil, *Sphænophorus planipennis*, said to be injurious to Cocoanuts in Ceylon.

The last two are both Coccidæ. If the insect theory is to hold, it will be perhaps to these small insects that we shall have to look for the damage. Two members of this family feed on the Cocoanut, *Aspidiotus destructor* and *Dactylopius cocotis*. I do not know that either of these insects has been reported in India, and it may be ultimately found that it is an insect, if insect it be, nearly related to one of these. In the Indian Museum Notes, *A. destructor* is described as follows :—

"A minute insect which, to the naked eye, looks like a mealy 'Scurf on the leaves. It has been extremely destructive to 'Cocoanut palms both in the Laccadive Islands and in l'Ile de 'Réunion. It sucks up the juices of the leaves to such an extent 'as to sap the vitality of the trees and to destroy great numbers 'of them."

This would cause the drooping of the leaf shoot as mentioned by your correspondent.

As the genus *Aspiodotus* is parthenogenous, thus resembling Aphidæ, enormous numbers of young would be produced in the spring and summer, consequently a correspondingly large amount of sap, which the trees could ill afford to lose, epecially in an extra hot year, would be sucked up.

With regard to remedies. For young plants, two to four feet high, I believe a mixture of kerosene and soap diluted might be used without evil effect, but it would have to be sprayed on several times. For older trees, if the attack is really a Coccid one, I shall also be interested to know the remedy.

E. STEBBING.

CAMP KAMABERA, SINGBHUM,
November 15*th*.

Obituary—M. Corbett.

We regret to have to record the death at Bahraich on the 25th inst. of Mr. Corbett, Forest Ranger, from fever, after a few days illness. Mr. Corbett passed his probationary service in the Oudh Circle, returning there to the charge of a Range after obtaining a certificate by the H. S. at the Forest School, Dehra, in March 1894. He stood third on the list and obtained a certificate with honours in an exceptionally full year. His early death, after only a few months service, removes a promising young Officer who was in every way suitable for special advancement in the executive branch. His fellow students of the 1892-94 class will hear of his death with great regret, a regret which is fully shared by the staff of the Dehra Dun Forest School and the Officers of the Forest Department of the N.-W. P. and Oudh

II.—CORRESPONDENCE.

The Malabar Steam Sawmills.

On reading the article on the Malabar Saw Mills in the September number, I found that the Printer's Devil had made a mess of Mr. Brown's initials. Mr. A. Brown is the proprietor of the Saw Mills and Mr. H. Brown, his brother, has the credit of erecting the buildings and machinery.

I forgot to mention amongst other interesting things, that I saw an automatic filing machine. This beautiful piece of mechanism was as perfect as human ingenuity could make it. The band saw revolved on two drums, and as the teeth of the saw passed a fixed spot, a file descended on them at regular intervals and worked at each tooth. It is impossible for me to describe in so short an article, so intricate and beautiful a piece of machinery.

Mr. Brown had also the usual emery wheel for machinery saws, worked by the engine.

I was much interested in some specimens of wood pavement I was shown. The woods selected where eminently fitted for the purpose; *viz.*, *Xylia dolobriformis* and *Hopea parviflora*. There were several circular saws at work. On looking over my notes, I find I made a mistake in my last article. It took 4½ minutes to saw the Candy of timber, which I timed. This is good enough work. An American planing machine was as simple and effectual a piece of machinery as I have seen yet and was engaged in planing white cedar planks for ceiling work. A visit to these works would well repay any engineer or Forest officer passing through Calicut.

R. M.

Pyingado for Wood-Pavement.

SIR,

I regret to see at page 413 of "*The Indian Forester*" for November 1894, a letter depreciatory of the value of Pyingado (*Xylia dolabriformis*) for wood-paving purposes. It is one of my most ardent wishes to see all the streets of London, and of our other large home cities, paved with this wood, which, I believe, notwithstanding Mr. Talbot's apparent opinions, to be eminently adapted for such a purpose. And if we in India, working with native labour and paying for the same in a very depreciated silver currency, cannot place our best hardwood on the London market at a cheaper rate than the Jarrah and other woods of the Australian colonies, where white labour is employed and paid for in gold, then there must be something radically wrong with our method of work, our supervision of subordinates, our energy or our employment of that energy and, more especially, of that technical education upon which we have hitherto rather prided ourselves as a Service. If there is any difference at all as to freight to London, then it is probably slightly in our favour,—whilst our landing charges are also paid for in silver and not in gold till the ship is ready to sail.

I am writing to ask my friend Mr. Bagley, Chief Engineer in the Burma Railway branch, to give me the benefit of his opinion as to the merits or demerits of Pyngado for wood-paving purposes; for I recollect that about 10 years ago various pieces of wood-pavement were laid down in Rangoon. I further recollect that, up to my leaving Rangoon in 1892, I never used to see these pieces of wood-pavement without admiring the way they maintained themselves.

It does not follow that, although the 'Jamba' of Bombay is *Xylia dolabriformis*, it must must necessarily have the same durability and technical qualities as the 'Pyingado' of Burma; but if Mr. Talbot gives the specific gravity of the wood he deals in, then a basis of opinion can be formed, seeing that, *for one and the same species of wood*, the heavier timber has the greater durability. Soil and climate are of vast importance with regard both to the amount of increment and to the technical quality of the wood produced by any given kind of tree: hence Mr. Talbot can hardly agree that because he does not think the Bombay 'Jamba' suitable for wood-paving, therefore the 'Pyingado' of Burma must also be subject to similar or identical disabilities.

His extract from the report saying that—

" We have not yet found anyone to take an interest in the ' Jumba. It is so hard that the expense of cutting into blocks ' would be excessive."

shews that something has been aimed at on the Bombay side, which is entirely different from what we want in Burma. *We want to convert our Pyingado into wood-pavement blocks, and to export them in the converted form ; for, if seasoned, our fine iron-wood would break the teeth of saws.*

Anyone who has travelled through the forests of Burma must recollect the thousands of bare dead stems which are to be seen throughout most of the recently cleared land and the old Taungya (*Jhoom, Kumri*) land in all the lower dry forest tracts. The vast majority of those dead stems are Pyingado, which the Burman does not try to cut down after girdling ; for he knows that, when once seasoned, the *Xylia dolabriformis* of Burma will turn the edge of his Dá or bill, it becomes so hard.

The forests of Lower Burma alone could yield probably from 200,000 to 300,000 tons of Pyingado per annum, and at a much lower rate than the Rs. 40 per ton for which 1,000 to 2,000 tons a year could be extracted in North Kanara according to Mr. Talbot.

Speaking from memory—for records are not at hand here in camp—details of the working of a little Pyingado saw-mill, formerly run by me in the Rangoon Division of the Pegu Circle of Burma, will be found in the Annual Reports for 1884 and 1885. Extraction for the Railway Department began about 1881 and was continued, first for the Forest Department and then afterwards for the late Mr. Rosner, who took over the saw-mill from us in 1885, at any rate until 1892 when I left Burma. From a comparatively small tract of forest, something like 40,000 to 50,000 logs of Pyingado must have been extracted within 10 years : and this from forests which never were anything like so rich in Pyingado as many of the lower hill forests of Tharrawaddy, Prome, Thayetmyo, Henzada, and Bassein on the Irrawaddy side, or of Pegu, Shwegyin and Toungoo on the Sittang side of Lower Burma alone, without taking Upper Burma into account at all.

Whatever London reports on Jamba may say, I am very hopeful that within a year a two we shall see a commencement of the paving of London streets with blocks of pyingado shipped from Rangoon, Moulmein, or Bassein in Burma. What is really wanted in order to ensure a start, and probably a very successful start, of a new and important industry, in this direction, is that the Government of India should sanction a certain outlay for the purpose of first obtaining permission from the London Vestries, and then the laying down of short stretches of pavement (say 50 yards at each experimental point) here and there in different localities like the Strand, Fleet Street, Cheapside, &c.. so as to enable the authorities at home to form an opinion as to its suitability for importation on a large scale. The opinion would probably be biassed at first, but I believe the good qualities of pyingado would force any such prejudice aside. It would pay Government extremely well in the long run, either to send home one of their Forest Officers of recognised business capacity, in order to run this particular branch, or else to wait till they have such an officer at home on furlough, and then utilize him for this particular special duty. But the former is the preferable alternative; for loss of time must in such a case mean lost opportunity—and opportunities once lost, seldom return. *Now* is the time for the Government of India to take active steps towards advertising and pushing their wares, before the Australian Colonies secure the London market with their Jarrah and other hardwoods. In this struggle for the greatest market in the world, the Australian Governments are not letting the grass grow under their feet like the Government of India, but are using every endeavour, both by means of selected officers and of a suitable outlay, for what are, after all, purely advertising expenses, to gain what one might call a firm foothold on the pavement of London and of all the great cities in Britain.. That '*Good wine needs no bush*' is an old proverb, and I am sure that if once the splendid qualities of pyingado had an opportunity of becoming known at home, they would soon be so well appreciated as ultimately to lead to the Burma exports of converted Ironwood being in excess of those of teak and of padauk combined. But nothing worth having is obtainable without exertion; and the longer the Government of India continue their *laissez faire* policy in respect of the forest produce with which they can supply Europe, the more will the market fall into the hands of the Australians; the greater will be the difficulty of obtaining any subsequent hold at all on the home market, and the less the chance of their realizing a handsome revenue that is possibly now within comparatively easy reach.

J. NISBET,

CAMP, LACHIWALA:
16th December, 1894.

Dy. Director, Imperial Forest School,
and Deputy Conservator of Forests,
Burma.

New Pension Rules for Forest Officers.

DEAR SIR,

The recent reports regarding the extension of the more favorable service and pension rules to Forest Officers, refer apparently to Secretary of State's men only; and if this is the case, the Government is doing a very great injustice to those officers who were previously selected and appointed in India, and who have borne the greater burden of the earlier struggles of the Forest Department, at a time when the emoluments were less, and the discomforts and difficulties of the life greater than they are now.

As long as those "locally appointed" are qualified for admission and retention in the Department, and as long as they are on the same footing as regards pay, work and responsibilities, it would be exceedingly unfair to treat them with less consideration in the matter of service and pension, than is shown to their colleagues appointed from England.

If the new rules are to have retrospective effect as regards the men appointed from Home, then they should apply also to those who were in the controlling ranks of the service at the same time as the Home men. Any distinction between the two sets of officers would be in direct opposition to the recommendations of the select committee of the House of Commons, when dealing with the grievances of the services generally.

In their own interests the Secretary of State's men should support the claims also of those appointed in India, for if the former are not to have their promotion retarded towards the conclusion of their service, it is obvious that the latter must be able to retire, without being required to put in a *greater number of years service* than the former.

FIDES SERVANDA EST.

Germination of Kharshu.

DEAR SIR,

The Kharshu (*Quercus semecarpifolia*) seeded here most abundantly this year in July, and, to judge from their size, the acorns were of very good quality. On the slopes of "Cheena Peak" I dibbled in acorns over about 60 acres and started a nursery in which I put about 7 maunds of seed or some 35,000 acorns. The nursery was on a gentle S. slope at an altitude of about 7,800 ft. with good soil and in the midst of a fine natural Kharshu forest. The sowings were carried out about the end of July with most of the acorns already sprouting.

All the labour has come to nothing, however, for not a single seedling has shown itself in the nursery, and none have been found in the forest, either from the acorns dibbled in, or from those naturally sown. The failure is the more noticeable as, certainly, 95 % of the acorns germinated, and put out vigorous radicles but there they stopped. I hardly think that the fortnight without rain in Naini Tal just after the sowing, is altogether responsible for the failure as, even then, the sun hardly ever penetrated through the clouds which enveloped "Cheena" and kept the atmosphere moist and cool, just such a one as the Kharshu generally lives in.

I should be glad to know what are the experiences of any others who have had dealings with Kharshu this year.

F. A. LEETE.

Note :—We hope some other Forest Officers will help to clear up the difficulty. In Jaunsar, the Kharshu seeded in June and when we left the hills in that month, the ground was covered with germinating seed. In October, however, few seedlings were visible, but we cannot explain the reason. On the subject of the curious mode of germination of Kharshu (as also, to a great extent, of 'Moru' (*Quercus dilatata*) we would refer our readers to Pandit Keshavanand's interesting article in our Vol. XVII.

Hon. Ed.

Flowering of a Bamboo in S. Canara.

DEAR SIR,

The bamboo known in this District as Ame Wotay flowered and seeded everywhere in the Forests of South Canara last February. About half the dying culms are now again attempting to produce a second crop of seed, naturally a poor one. The February crop must have been a very heavy one, for the ground is densely clothed with a carpet of young plants from 1 in. to 4 in. I have issued orders to the Rangers to collect as much seed as possible next February. This bamboo is a very handsome one, the culms being very straight, thornless and from 2 in. to 5in. in diameter. It is used for basket and mat making and is epecially useful for putting up temporary Forest Camps, as huts can be run up in half an hour This bamboo very closely resembles *Beesha Travancorica ;* but unlike it, is not a producer of large fleshy seeds. The Villagers collected large quantities of the seed which they have husked and eaten in the shape of porridge, cakes, &c.

I collected some flowering specimens ; but they were unfortunately ruined by the heavy rain and damp. Of seedlings, I have secured a considerable stock, and will distribute them to any one wanting them and caring to pay the cost of carriage.

R. MORGAN.

III.-OFFICIAL PAPERS & INTELLIGENCE.

Enquiries regarding Indian Trees.

The following circular has been issued by the Inspector General.

"In forwarding herewith, for information and distribution 'among such Divisional Forest Officers as you may select for the 'purpose, copies of two notes on (1) *Xylia dolabriformis ;* and '(2) *Chickrassia tabularis,* I have the honour to request that you 'will be good enough to cause specimens of the wood (seasoned if 'possible), &c., of these trees to be forwarded to the Reporter on 'Economic Products, Indian Museum, Calcutta. The object of this 'requisition is to obtain collections of selected specimens of the 'various portions or products of the two trees for purposes of exhibition and experiment at the Imperial Institute, London, and 'at the Indian Museum, Calcutta, and the notes indicate the contributions which it is desired should be made."

We append the note on the first mentioned species for our readers' information.

1. Objects of the Collections.—Before proceeding to give an abstract of the available information on this subject and to indicate the collections which it is desired should be made, it may perhaps be as well to mention the circumstances that have led to the selection of two timber-yielding trees for special consideration this year.

The policy adopted by the Government of India with regard to all other products required for the Imperial Institute has been to restrict investigations to a fixed number of articles each year. The Inspector General of Forests has concurred that similarly it would suffice to confine the preparation of logs of timber, in illustration of our more important commercial trees, to two species a year. Last year the timbers of *Albizzia Lebbek*, and *Ptrocarpus indicus* were dealt with, but the experience thus gained has shown that an economy of time and labour would very possibly be effected were every product that a tree affords taken in hand at one and the same time. Instead, therefore, of indenting on local officers for the resin of *Xylia* this year, the timber at some future date, and its oil-yielding seed at still another period, it is proposed that the present enquiry should, in the matter of collections, dispose of that species once and for all. This is the more necessary since at the Museum it is contemplated that over above the panels of timber (which are intended to illustrate our trees) glass cases will be placed, in which would be shown a botanical specimen of the plant, a drawing of its flowers, etc., a photograph of the tree, and small samples of each of its useful products, such as its gum, dye, fibre, medicine ; also interesting articles of dress, furniture, or sport, etc., etc., made from its timber, fibre, branches, leaves, etc., etc. Such collections would therefore illustrate graphically the value of each tree. By concentrating enquiry in this manner, it is believed that information regarding many products and uses of the trees in question will be brought to light that may possibly have been entirely lost sight of through the former system of special indents, product by product. The extent of these auxiliary contributions, over and above the supply of logs of timber, is thus a matter left to the discretion of the officers who may have to deal with this subject. Photographs (in duplicate) of typical examples of each species of tree would be most acceptable. If taken specially, a man of average height should be placed near the stem, and if possible the photograph should give little else but the tree intended to be shown.

In concluding this explanatory note. it may be as well to add that attention should not, of course, be confined exclusively to the various subjects dealt with in the abstract given below. If other uses or other products are known to the officers who may conduct the enquiry and prepare the specimens, these would be of very special interest. and should most certainly be contributed.

(2). *Habitat.*—*Xylia dolabriformis*, the 'Pynkado' is a large deciduous tree met with in the Central Provinces, South India, and Burma.

Information on the following among other points is desired :—

(*a*) Its vernacular name or names in your district, given in *printing* Roman character.

(*b*) The season at which it flowers and fruits. This is most important in order that the period when seeds can in future be obtained may be known.

(*c*) The area of its occurrence and prevalence ; that is to say, the part or parts of your locality where it is most abundant or most accessible.

(*d*) The nature of the soil and of the climate on which it is seen to greatest advantage.

(*e*) The names of the three or four most common trees with which it is generally associated.

(*f*) The height it attains and the diameter of its stem when full grown.

(*g*) The number of years it is supposed to grow before attaining these proportions.

(*h*) The method by which it is most readily propagated.

(*i*) Kindly furnish at least two botanical specimens showing leaves, flowers and fruits. You will find a note on how to dry specimens in *The Agricultural Ledger*, No. 4 of 1894, that may perhaps be of some use in indicating the nature of the samples that might be furnished.

It is commonly reported to afford the following products :—

3. Resin.—It is supposed to yield a red resin more especially in Burma. Kindly supply a sample of not less than 5lbs. in weight. The lac insect is reported to be sometimes found on it. If this be so, please furnish a specimen of the twigs encrusted with lac of about the quantity mentioned for the resin.

Information on the following points would be most valuable :—

(*a*) Does the resin exude naturally or only in consequence of some injury ? If the latter, kindly describe the process adopted to secure a supply.

(*b*) At what season of the year is it obtained ?

(*c*) How much does each tree afford per annum ?

(*d*) At what price per 100 lbs. could it be landed at the railway station or local mart ?

(*e*) How much approximately might be expected to be produced annually from your district ?

(*f*) Is it used by the Natives, and for what purposes ?

(*g*) Has the resin any special name by which it is known in local trade ?

(*h*) Does the tree possess any advantage as a plant on which to rear the lac insect ?

4. Oil—It is stated that the seeds yield an oil. Kindly furnish a sample of some 10 lbs. of these seeds. If the oil is prepared locally, it would be most desirable if you could furnish at least two quart bottles of it, and, say, 4 lbs. of the oil-cake left after expression of the oil.

On the subject of the oil, [the following points might be investigated :—

(*a*) What weight of seeds might be expected from each tree ?

(*b*) At what price could the seed be sold per 100 lbs.?

(*c*) What is the yield of oil to the weight of seed employed in its preparation ?

(*d*) Is the oil obtained by hot or by cold expression ? Describe the process.

(*e*) What is the oil used for, and what are its reputed properties ?

5. Timber.—This hard and very resinous wood seems to be highly appreciated in the localities where it is to be had in fair abundance. It is generally known as Iron-wood because of its weight (60 to 86 lbs a cubic foot). Is this weight correct?

It would be desirable to obtain from each contributor one log, about 7 feet long—a size that would be sufficient, when cut in half, to make two good samples. One or two logs would be used up in fittings in order to show the nature of the wood. If possible, one log should bear (at least on one side) a portion of the bark. The selected log which each contributor proposes to supply should be well seasoned by being kept in a dry shed for some time before being despatched, and it would *not* be necessary to dress it in any way. That can be done on its arrival in Calcutta and London.

It may be anticipated that as the result of this requisition some 8 or 10 logs may be obtained from the whole of India; and, if so, that quantity would suffice. It is desirable to see whether the wood varies materially in the various provinces where it occurs, and also to have one or two spare logs to give to the trade for experimental purposes. Should, however, this requistion result in our obtaining only two or three logs from all India, it might then be necessary to indent a second time. These circumstances are mentioned so as to obviate the risk of too much or too little being supplied. This would be prevented by each intending contributor informing the writer whether or not he could supply a log of the nature specified. On these replies coming to hand, a selection could be made and the exact quantity required subsequently requisitioned.

Information on the following points would be desirable :—

(*a*) At what price per ton could the timber be landed at the nearest railway station or seaport?

(*b*) How much a year might be expected from your forests?

(*c*) What sizes could be supplied?

(*d*) For what purpose is the timber mainly used locally?

(*e*) If not very costly, could you supply a selection of the smaller articles usually made of it, more especially those that might be both attractive, and which would help to exemplify its special properties?

6. Conclusion.—While no restraint is desired to be placed on the liberality of contributors both as to the communication of useful information or the supply of specimens, it is not intended that the above categorical statement should be regarded as an imperative obligation. It is hoped that by representing, as has been done, all the known properties of the plant, and by pointedly drawing attention to the chief features regarding it (on which information is desired), the labour of the officers who may have to reply will be greatly lessened, and that the information ultimately obtained (from all parts of India) will afford material for a more comprehensive account being published than we at present possess.

IV.—REVIEWS.

The Forests of Travancore.

Through the kindness of the Conservator, Mr. T. F. Bourdillon, we have received the Report on the forests of his charge which was published in 1893. It is very full and detailed and serves admirably as a basis for the yearly record of progress and administration which may now be expected to issue. As our readers know, Travancore is a large and prosperous Native State on the Malabar coast in the extreme South of the Indian Peninsula, between the parallels of North latitude 8° 8′ and 10° 22′, and occupies an area of about 7,000 square miles. It has a population of about 2½ millions and gives a revenue of 77 lakhs with an expenditure of 70 lakhs. The lands of the coast are all cultivated, the forest country occupying the slopes and crests of the Western Ghats up to a maximum elevation of 8,840 feet. The climate of Travancore is very equable, owing to the sea-breezes, the temperature on the plains rarely rises over 90 degrees, while in the coldest weather it rarely falls below 70 degrees. On the hills, of course, the changes are greater. The rainfall is heavy : on the coast it varies as one proceeds north, from 41 in. to 114 in. ; while on the Ghats it may run up to as much as 210 inches in the hills of Peermaad.

It would seem that Forest Conservancy is of very ancient date in Travancore compared to its commencement in British India, for Mr. Bourdillon mentions that in 1816 to 1820 a Deputy Conservator was stationed at Ráni to see teak felled and sent down to Allepey, where it was sold by the Commercial Agent who was the Conservator of Forests and regulated also the Cardamom collections.

For the general description of the forests we cannot do better than quote Mr. Bourdillon, who writes as follows :—

"In describing the forests within the above boundaries, I 'cannot do better than divide the whole region according to the 'catchment area of each river, a method which will enable 'me to describe the forests and the rivers themselves in detail, 'and afterwards to sum up the results of my explorations. It 'must not be supposed that this area includes all the waste land, 'or even all the forests in Travancore. Outside this area, there is 'a considerable extent of land suitable only for forests, or grazing, 'such as the Velimala hills near Nagercoil, but these are isolated 'blocks which may be left out of consideration, until the rest of 'the forest area has been put under a thorough system of 'conservancy.

'From what has been already said, and from the analogy of 'other countries, it may be inferred that the forests of this 'region do not all present the same characteristics, and I have, 'for convenience sake, divided them into four classes.

'(1) Heavy moist forests of evergreen trees.

'(2) Land originally covered with moist forest, but now 'overspread with scrub of various ages, the resulting growth 'after being abandoned by hill cultivators.

'(3) Deciduous forest, with grass growing under the trees.

'(4) Rock, and land covered with short grass, and useless 'for any purpose except pasture.

'The *first* class of forests at one time extended all over the 'low county of North Travancore, but as it covered the best 'soils, it has been gradually cut down there, and is now confined 'to the slopes of the Hills, and to perhaps one-third of the upper 'hill plateaux. The trees composing it grow very close together, 'and exhibit an extraordinary variety of species, and owing to 'the absence of grass and to the fact that the trees themselves 'are evergreen, forest fires do very little harm here. In spite of 'the great choice of woods they offer, these forests are, as a rule, 'less valuable than the deciduous forests of class 3, the greater 'part of the timbers being unknown ; nevertheless some of the 'woods command a high price.

'The following are the most important :—

'Ebony—Diospyros melanoxylon ?
'Kambogam—Hopea parviflora.
'Anjili—Artocarpus hirsuta
'Jack—A. integrifolia
'White Cedar—Dysoxylum malabaricum.
'Red Cedar—Cedrela Toona.
'Punna—Calophyllum tomentosum.
'Nanga—Mesua ferrea.
'Gamboge—Garcinia Cambogia and 4 other species.
'Puthangkolli—Pœciloneuron Indicum.
'Cotton—Bombax Malabaricum.
'Chini—Tetrameles nudiflora.
'Enna—Dipterocarpus turbinatus.
'Payini—Vateria indica.
'Vedi pilava—Cullenia excelsa.
'Pola—Sterculia alata.
Mala-uram—Pterospermum rubiginosum, and 2 other kinds.
Olan kara—Elæocarpus serratus, and 2 other kinds.
Peru—Ailantus malabaricus.
Dammer—Canarium strictum.
Vengkotta—Lophopetalum Wightianum.
Kadapilavu—Kurrimia paniculata.
Mango—Mangifera indica.
Redwood—Gluta travancorica.
Then chera—Semecarpus travancorica.
Ambalam—Spondias mangifera.
Shurali—Hardwickia pinnata.
Malam puli—Dialium ovoideum.
Kurangadi—Acrocarpus fraxinifolious.
Mutta Kongu—Pygeum wightianum.
Naval—Eugenia, several species.

' Manimarutha—Lagerstrœmia flos-reginæ.
' Kadamba—Adina cordifolia.
' Pala—Chrysophyllum roxburghianum.
' *Do*—Dichopsis elliptica.
' Karin thuvara—Diospyros microphylla and insignis, and 2 other species.
' Erilappala—Alstonia scholaris
' (often found also in grass land.
Nutmeg—Myristica laurifolia and 4 other species.
Cinnamon—Cinnamomum zeylanicum and others.
Kola mava—Machilus macrantha.
Thondi—Bischofia javanica.
Aval—Holoptelea integrifolia.
Ara anjili—Antiaris toxicaria.
Fig—Ficus, 9 or 10 species.

'The *second* class of forest contains no timber of any value except Vaga (*Albizzia procera*), as the bushes and scrub springing up after a burn are of useless kinds of trees, such as Ama—*Trema orientalis*, Vattakanni—*Macnranga Roxburghii*, *Clerodendron infortunatum*, *Mallotus albus* and Vettilapatta—*Callicarpa lanata*, and so on.

'All of these bushes or small trees are short lived, and after growing for perhaps ten years give place to better kinds of trees.

'In this class are included all lands cleared for cultivation of any sort, whether for coffee, tea, rice, or other produce.

'The *third* class consists chiefly of forest growing on poorish land lying at the foot of the hills, and is very abundant in South Travancore. These grass forests are found also covering the ridges and higher ground, where the soil is too dry for the moist forest to grow A small part of the hill plateaux also is covered with forest of this description.

'The deciduous forests contain a much smaller number of species of trees than the moist forests, but their value is greater. The most important of these are—

' Teak—Tectona grandis.
' Blackwood—Dalbergia latifolia.
'Sandalwood—Santalum album
' Irūl—Xylia dolabriformis.
' Vēnga—Pterocarpus Marsupium·
'Thēmbāva—Terminalia tomentosa.
' Ven Teak—Lagerstrœmia lanceolata.
' Meili—Vitex altissima
' Pūvan—Schleichera trijuga.
' Vekkali—Anogeissus latifolius.
' Mullu Vēnga—Bridelia retusa.
' Ven Marutha—Terminalia paniculata.
' Thāni—T. belerica.
Nay Thēkka—Dillenia pentagyna.
Nux Vomica—Strychnos Nux-vomica.
Gallnut—Terminalia chebula.
Uthi—Odina Wodier.
Kumbil—Gmelina arborea.
Pēra—Careya arborea.
Nelli—Phyllanthus Emblica.
Vāga—Albizzia procera.
Mūra—Buchanania latifolia.
Chinna Kadamba—Stepegyne parvifolia.
Mala uthi—Stereospermum xylocarpum.
Murukka—Erythrina indica, and some others

'These forests suffer much from grass fires which become 'yearly more intense as the trees are felled, and the grass is thus 'encouraged to grow, while the branches and tops of the logs left 'about feed the flames.

'The *fourth* class of forest is, of course, worthless, as far as 'timber is concerned."

The area of forest land in Travancore is superintended partly by the Conservator of Forests, partly by the Superintendent of the Cardamom Hills. The areas under either are, in square miles :—

		Cons. of Forests.	*Supt. of Cardamoms.*
Moist forest	...	980¼	221
Secondary forest	...	442¾	140
Grass forest	...	504	42
Useless land	...	209	505
	...	2.136	908

Total ... 3,044 sq. miles.

The Report goes on to give a minute and very interesting description of the practice of 'Shifting cultivation,' which in Travancore is called 'Virippu' or 'Malam Krishi' and then proceeds to describe the chief timber trees of which 23 are enumerated and described in detail.

These are :—

1. Teak	Tectona grandis, Linn. f.
2. Blackwood	Dalbergia latifolia, Roxb.
3. Ebony	Diospyros Ebenum, Kön. or Melanoxylon, Roxb.
4. Sandalwood	Santalum album, Linn.
5. Anjili	Artocarpus hirsuta, Lamk.
6. Kambogam	Hopea parviflora, Bedd.
7. Venga	Pterocarpus Marsupium, Roxb.
8. Themboak	Terminalia tomentosa, W. and A.
9. White cedar	Dysoxylon malabaricum, Bedd.
10. Red cedar	Cedrela Toona, Roxb.
11. Ven teak	Lagerströmia lanceolata, Wall.
12. Jack	Artocarpus integrifolia, L.
13. Irúl	Xylia dolabriformis, Bth.
14. Mayila	Vitex altissima, L. f.
15. Manjakkadambu	Adina cordifolia, Hk. f.
16. Púvan	Schleichera trijuga, Willd.
17. Mainmaruthu	Lagerströmia Flos-Reginæ, Retz.
18. Mango	Mangifera indica L.
19. Punna	Calophyllum tomentosum, Wight.
20. Chini	Tetrameles nudiflora, R. Br.
21. Pathiri	Stereospermum xylocarpum, Wight.
22. Ilavu	Bombax malabaricum, Dc.
23. Karunthagara	Albizzia procera, Bth.

but many others of use and value are mentioned and an appendix contains a full list of the trees of Travancore which is a most valuable work, compiled as it is by an officer of such well-known botanical knowledge and experience as Mr. Bourdillon.

We could not hope, in the limits of a review in these pages to do anything like justice to the information afforded, but we venture to quote the following on the teak tree and its distribution in Travancore as a sample of the pains taken to describe it accurately :—

" *Tectona grandis*, Linn. fil., English : teak, Tamil : thēkku. 'Malayalam : thēkka. The teak tree belongs to the order Ver'benaceæ. Its appearance is so familiar to every one in South 'India that it need not be described here, further than to say that 'the leaves are opposite, about 10 or 12 inches long, and nearly 'as broad, rounded, and with a pale under side. The foliage is 'sparse, and the whole of it falls at the same time, once a year in 'the hot season, leaving the branches bare. The teak tree flowers 'in June and July, and its fruit ripens in the dry weather, January 'to March. The flowers are white, about ⅓ inch in diameter, and 'are clustered in large bunches at the ends of the branches. The 'fruit consists of a nut enclosed in a spongy covering, which is 'further enveloped in the enlarged calyx, a loose case of one 'inch or more in diameter. The nut contains normally 4 seeds, 'but 2 or 3 are usually abortive, so that not more than one or 'two plants grow from each fruit. The only tree which is some'times mistaken for teak is the *Dillenia pentagyna*, Tamil : nay'thēkku, Malayalam : koda-punna, whose large leaves somewhat 'resemble the leaves of the teak, but on closer inspection the 'former can easily be distinguished by their pinnate venation, 'and their serrated or jagged outline, while the veins of teak 'leaves are distant, and their edges are regular. The flowers and 'fruit of these two trees are quite dissimilar.

'The teak tree is indigenous in south-western and central 'India up to 25° north latitude and in Burma, Pegu, Java and 'Sumatra. In other parts of India north of 25°, it is cultivated, 'as in Bengal, Assam, Sikkim and the North West Provinces, and 'it has been introduced into Ceylon, but it is not indigenous in 'those countries.

'Teak grows best in a temperature ranging between 60° and '90°. It can bear cold greater than that indicated by these figures, 'but under such conditions it does not attain large dimensions. 'As regards moisture, the annual rain-fall should be not less than '50 nor more than 150 inches, and if there is a long period of 'dry weather, teak, owing to its habit of wintering and its ability 'to stand drought, will be found to form a larger proportion of the 'forest trees than if the rain-fall were more evenly distributed 'through the year.

'The teak tree grows from sea level up to 3,000 ft. or in
' some cases to 4,000 ft. but in Travancore the former altitude is
' its highest limit, and, at this height, it does not thrive so well as a
' little lower down. The most suitable aspect is south west.

'Teak is found growing in all kinds of soil and in various
' localities, on sand-stone, granite, and lime-stone, on the steep hill
' sides, and on the alluvial land on the river banks. But, as Dr.
' Brandis* points out, "under all circumstances there is one indispensable
' condition, perfect drainage, and a dry subsoil."
' When it occurs on a hard subsoil through which its roots cannot
' penetrate, the rapidity of its growth diminishes after a certain
' time, and the annual increment of its volume is very small.
' Under such conditions it becomes a question whether it is not
' better to fell the trees at an early age, as the yearly growth
' attained does not compensate for the loss of time.

"It is only in open forests of deciduous trees that teak is
' met with. During the hot weather it loses all its leaves, and
' growth ceases for a time. If it were found near evergreen trees
' which do not winter in the same way, and which retain their
' vitality and power of growth throughout the year, they would
' take advantage of its period of inactivity and would occupy the
' land to its exclusion. Thus, teak is only seen in company with
' bamboos, or with trees that winter in the same way as it does, or
' are not aggressive, such as *Dalbergia latifolia*, *Pterocarpus
' Marsupium*, *Terminalia tomentosa*, *T. paniculata*, *Anogeissus
' latifolia*, *Schleichera trijuga* *Gmelina arborea* *Sterospermum
' xylocarpum*, *Careya arborea*, *Phyllanthus Emblica*, and others.

' In Travancore, the teak is usually found on the lower slopes
' of the hills and at their feet, for here the extent of evergreen
' forest is small. Farther inland, such forest occupies all the
' valleys, and the teak is driven up the hill sides, where the soil
' is too dry to support evergreen trees.

'In certain situations, this tree often forms the greater part
' of the forest, purely, I believe, because it can stand a drought
' greater than would suit any other tree. But even teak does not
' thrive on slab-rock with a covering of about a foot of mould over
' it, and in such situations it does not attain a large size, but the
' trees often grow very close together. Such trees are called
' kōl-teak.

'I have endeavoured without success to ascertain the derivation
' of this name. †The word kōl may mean a stick or pole
' of any sort, or it may mean the particular measure used for
' calculating the dimensions of timber. Thus, kōl-teak may be
' either saplingteak, or teak of such small size that only a kōl
' length of timber can be cut from it. Neither derivation exactly

---

*Forest Flora of N. W. Provinces, pp. 356.

† It has been suggested to me that kōl-teak may be teak whose circumference is less than one kōl.

‘agrees with the ordinary acceptance of the term. In the proclamation of 1853 kōl-teak is defined as teak under 10 vannams—(12½ inches) quarter girth, but this manifestly includes, not only all old stunted trees that would never attain larger dimensions, but also all young trees that certainly would be larger. Again, the Report of the Forest Commission in 1884 (para 15) defines kōl-teak as “teak growing in poor soil and in the open country,” and this properly defines it, but does not explain the derivation of the term. Kōl-teak is teak growing in unfavourable situtions, such as on laterite, or on rock with very little surface soil, and, in consequence, so stunted that it would never attain large dimensions however long it lived, would never in fact be more than a pole.

‘The greater part of the teak found in the low country is kōl-teak because there is so much laterite and rock on the dry hills, but the kōl-teak of North Travancore, growing on laterite, is much finer than the kōl-teak of South Travancore which grows upon a stratum of rock. Some good teak of large dimensions is seen in the low country, whereas on the banks of rivers the soil is deep and fertile.

‘On account of its slow growth, kōl-teak has usually a different appearance to the fast grown teak of the better land. It is darker in colour, contains more oil, and is considerably heavier. This has led some people to speak of it as a species distinct from ordinary teak, and to call it “bastard teak.” This is quite a mistake.

‘The finest teak in Travancore is to be found on the hills at at an elevation of from 1,000 ft. to 2,000 ft. The Idiyara valley, the sides of which run up to more than this elevation, used to be celebrated for the quantity and size of its teak. Dr. Balfour in his “Timber Trees” mentions that a Mr. Edye, about the beginning of the century felled a tree in this valley seven feet in diameter at its base, and 26 inches in diameter at 70 ft., from its butt. This would give about 58 candies, or 900 cubic feet of timber. In the Trevandrum Museum there is a plank sawn from a tree felled in the same valley which is 4 ft. 3½ in. across. The conditions to be found in the Idiyara valley are peculiarly favourable to longevity. The teak tree is there seen growing in thickets of the éetta reed (*Beesha travancorica*), and it therefore does not suffer from fire as would be the case in grass land. The soil also is very fertile, and the climate forcing, while there are no violent winds. Thus those trees which, in other places and under less favourable conditions, would be burned or blown down, continue in this valley to grow, adding on a small increment to their size year by year.

‘It is particularly important to remember that this large size is not due to rapidity of growth, but to great age.

'*The plank I have mentioned as having been deposited in the Trevandrum Museum, shows 156 rings, and at least 50 more would appear if the plank had been sawn from the centre of the tree. These concentric rings, which indicate the age with exactness, are in this plank never more than ¼ inch apart, and sometimes two consecutive rings are no more distant from each other than the thickness of a piece of note paper. This tree therefore must have been well over 200 years of age, and Mr. Edye's seven foot tree must have been a veteran of 4 centuries.

'The Idiyara valley and all the accessible forests of Travancore have been worked for teak for at least a century, and, knowing this, it is not surprising to find that there is little or no large teak left anywhere in the country except in very out of the way places, from most of which it will never pay to remove the timber. Of third class and kōl-teak there is a fair quantity.

'I estimate the total number of standing teak trees of good size, that is of the first, second, and third class above 8 virals (10 inches) quarter girth as 100,000 and of kōl-teak and smaller trees at about 400,000. I refer to timber that can be brought down at a profit, and I do not include such as grows on the Periyar above Karimanal, and is inaccessible, saving what can be taken to Ramakkal or Kumili. These trees are scattered over about 400 square miles of country.

'The number of teak logs sold by the Forest Department every year is not less than 12,000, (of which about 2,000 are below 8 virals quarter girth) if we include those sawn up and delivered at the depôts of Shencottah, Quilon, &c. by contractors. There are also some 10,000 sleepers annually sold to the Bombay firms. Comparing these figures with those already given as showing the number of standing trees left in the country, it will be seen that the supply of good-sized timber at the present rate of consumption will be exhausted in about ten years, leaving nothing but immature and inferior wood. Besides this, there is a supply of felled timber lying in the forest sufficient for about two years.

'That the quantity of teak still remaining in Travancore is very small, is well known to everyone who has anything to do with the forests. The present Conservator, Mr. Vernède, is well aware of this state of things, and has more than once noticed it to me, and in his Annual Reports for the last 5 years, as well as in former years, has urged the necessity of extending the plantations, in order to counterbalance the drain on the forests of the country by the annual felling of so many trees. To any one resident for a short time in one place, though knowing

---

*In a pamphlet by Mr. Bryce of the Bombay and Burmah Trading Co. upon teak, he says "In a tree 8 ft. in circumference, I have counted 380 rings of annual growth, so that the great trees of 6 ft. diameter must have reached an age of several thousand years."

'nothing of our forests, the rapid disappearance of teak from some 'parts is very apparent, and I have been frequently told that in 'such and such places the tree has been almost exterminated in a 'very short time.

'Another proof of the growing scarcity of the timber is the 'increased cost of working it to the depôts, the contractors now 'refusing to undertake any contracts except at higher rates than 'formerly. If the quantity felled was not in excess of the annual 'reproduction, the contract rates should be less than formerly, 'for the contractors now have roads and means of exploiting 'their logs which were not available to them before.

'The question of the rate of growth of teak as bearing on 'the profits to be expected from plantations is one of the 'greatest importance. As the result of many experiments, it 'has been proved to a certainty that the concentric rings seen 'so markedly in teak wood exactly indicate the age of the tree, one 'ring being added on each year. In his Manual of Indian Timbers, 'Mr. Gamble gives the diameter measurements of 29 trees with the 'number of rings in each, showing that the average width of a ring 'of wood is nearly half an inch, that is to say 2·62 rings go to the 'inch of radius: in other words teak increases at the rate of an 'an inch in diameter in 1·3 years.

'I have made measurements of a great number of trees grow'ing in the forest, and I find that the average increase is certainly 'not more than ¼ inch of radius in a year, that is to say that the 'increase in diameter is 1 inch in 2 years, and it is usually much 'less. I find that, as a rule, unless the soil is particularly rich 'and deep, the rate of growth of the tree, which is rapid up to '40 years of age, sensibly diminishes after that time. Under 'ordinarily favourable circumstances, at 40 years old a teak tree 'should be 20 inches in diameter at 2 ft. from the ground, exclud'ing the bark, and 25 inches at 60 years. These figures would 'show that the growth of teak is not so rapid in Travancore as it 'is in other parts of India, but Mr. Gamble admits that his measure'ments were taken from particularly good specimens grown in 'plantations, and Dr. Brandis says that it generally takes a teak 'tree 100 years to attain a girth of 6 ft. at 6 ft. from the ground. 'The growth here may therefore be considered as much the same as 'it is elsewhere. As a matter of fact, the logs of 20 and 25 inches 'in diameter delivered at the depôts are more than 40 and 60 years 'old respectively, being probably double that age, but they have 'been exposed to forest fires, and have been distorted and retarded 'in growth accordingly.

'As to the age to which trees may live, all depends on the 'character of the soil and the conditions that affect them. Under 'favourable circumstances, teak will live and go on growing slowly 'for 400 years or even more, but this is exceptional, and as the 'annual increment at an advanced age is small, most trees fall to 'the axe between 60 and 100 years old by which time they should 'be about 2 ft. in diameter.

'Although the teak tree, compared with some other trees, does 'not increase much in diameter from year to year, it shoots up 'vertically with very great rapidity. Under favourable circum-'stances, it will rush up 10 ft. the first year, and 5 ft. a year for the 'next 10 or 11 years. So that at 12 years old it is 70 ft. high, 'and 6 inches in diameter. After that the tree makes but little 'upward growth, but continues to increase in diameter with great 'regularity.

'The ash of teak timber forms only about 1 per cent of the 'weight of the wood: this tree therefore exhausts the soil to a 'very slight degree. Of this 1 per cent., ·22 of the ash consists of 'magnesia, ·27 phosphoric acid and ·33 of silicic acid, the other 'constituents of the ash of plants including potash, soda, and 'lime being poorly represented.

'The weight of teak when freshly cut is about 55 lbs a cubic 'foot, and 40 lbs when thoroughly dried; so that the wood 'floats easily after being well seasoned, but large logs take 2 or 3 'years before they have parted with their moisture. The value of 'P is set down at 600, so that for cross strains teak is not so strong 'as many other timbers, as blackwood for instance. The great 'value of teak lies in the fact that it does not warp or twist, that 'owing to the essential oil found in it, it is not eaten by white ants, 'and that it possesses a straight grain, and is easily worked, and 'finally that it can be obtained of large size.

'These numerous good qualities make it available for a great 'number of purposes, and teak is probably the most generally 'useful wood in the world. For shipbuilding and the backing of 'ironclads it stands unrivalled, on account of its great powers of 'resistance. It is very extensively used for railway carriages, for 'house building, and for furniture of all kinds, and lastly, it is em-'ployed in the construction of bridges, and other works in the open 'air. As, in our moist climate on the west coast, teak wood does 'not maintain its strength more than 7 or 8 years, it seems to me 'a waste to expose this valuable timber, which is already becoming 'scarce, to the destroying influences of sun and rain, when if kept 'under cover, it would probably last for hundreds of years.

'Teak now sells in Travancore at from Rs. 10 to Rs. 17 a candy, 'or say 10 annas to Re. 1 a cubic foot. Elsewhere, the price is at 'least double this, but Travancore teak is now-a-days mostly so 'small and so much damaged by fires, which cause heart and radial 'shakes, or by borers, that it is less valuable than the same wood 'grown in other countries.

'Teak found in the low country of Travancore suffers much 'from a borer which tunnels irregular holes of the diameter of a 'lead pencil in different directions through the wood. This boring 'is entirely due to the abominable system of lopping the leaves 'of this tree for manuring paddy fields. In May and June, 'when the teak is in full growth, the owners of the neigh-'bouring paddy lands strip the trees of all their leaves, leaving but snags all the way up the stem, and a tuft of a few leaves at the top. If this lopping were performed in the dry weather, when the tree was resting, the damage might not be great, because the branches which had been cut back would then possibly sprout again when the season of rest was over, but as the lopping is practised when the trees are in full growth, the sap, trying to find an exit, instead of forming buds at the ends of the branches, expends itself in sprouts thrown out from the sides of the old branches which then die back: and, as this lopping goes on year after year, a large extent of dead wood is left in the places where the old shoots once grew, all up the tree. This dead wood is seized on by a certain species of moth, which Mr. Cotes of the India Museum, Calcutta, thinks to be identical with the coffee moth (*Zenzera coffæophaga,*) as a place of deposit for its eggs and from these eggs the borers hatch out and tunnel into the wood, which in bad cases thus becomes thoroughly riddled, and is then quite useless for any purpose except for rough out-of-door work, posts and so on. These borers may be found in the lopped teak trees any time between June and the following February, after which they pupate, and finally, the perfect insect emerges about one year after the egg which originated it was laid; but this requires further confirmation, as I have not been able to thoroughly trace the successive stages of its growth. That the lopping of the trees is entirely answerable for this great destruction of valuable timber can easily be proved, for no signs of any such boring are ever to be seen in trees growing in the forest at a distance from cultivation, and which are therefore not lopped. The annual loss to Government must amount to many thousands of rupees, all of which could be saved by prohibiting the baneful practice of lopping."

Each of the principal trees is thus described with a great quantity of new and valuable information regarding them and their habits and sylviculture. Sandalwood is only found in Travancore in the Anjinâda valley in the extreme North-West of the State. Of Blackwood and 'Vengai', it is said that all that is necessary to ensure their good reproduction is to keep down the grass fires. White cedar is used in the construction of casks to carry cocoanut oil. *Adina cordifolia* wood is used in turning and can be recommended to those of our readers who suffer from insomnia because "bedsteads made of it are said to have a very soporific effect."

It would take too long to quote even a portion of the interesting information given, so we will content ourselves with the following extract regarding the bamboos :—

"Of bamboos and grasses, the most useful is the ubiquitous bamboo *Bambusa arundinacea* (Retz) called by the people "mūngil," "mula," and "illi." Its uses are too well known to need description. It dies down at intervals of from 25 to 30 'years, and 8 or 10 years must elapse before full sized culms 'can be obtained. A general seeding occured in South Travan- 'core when Lieut. Ward was travelling through the country in '1817, and another in 1870. This last was confined to the area 'south of the Acchankōvil river. North of this river, the seeding 'occurred about 1879-80, and it has been impossible to get 'full sized bamboos in North Travancore ever since. The male 'bamboo, or "kal mungil" *Dendrocalamus strictus* (nees) 'is, to my knowledge, only found in Travancore in the Anjināda 'valley at an elevation of about 3,000 feet. Its almost solid 'culms are used for carriage shafts, spear handless and other 'purposes. A species of thornless bamboo which Mr. Gamble 'has called *Oxytenanthera Bourdilloni* is found only on the hills 'at elevations over 3,000 feet, and there only growing on rocky 'cliffs. It is known to the Hillmen as "pon mūngil," "kāmbu." 'and "arambu." This bamboo attains a diameter of only about '4 inches, but the internodes are unusually long, and the walls 'of the culms are very tough. The Hillmen use it for making 'combs and other household implements. It is said to flower 'only at long intervals and did so in 1888-1890. The "ēetta 'or "irūl" reed *Beesha travancorica* (Bedd) forms the under- 'growth of our forests over immense areas in different parts of the 'country and near the crest of the hills it often occupies the whole 'of the ground, covering the slopes with dense and almost im- 'impenetrable thickets. Its presence is generally indicative 'of free but poor soil. Land that has been cleared for hill 'cultivation and has been abandoned, often becomes covered with 'thickets of this reed, though, before the clearing was made, 'there may have been only a few clumps of it growing in the 'forest. The Hillmen use this *Beesha* largely for their temporary 'huts, the reeds themselves being employed for the frame work, 'and the leaves to thatch them. The reeds are also much used 'for fencing, basket making, mats, &c. An excellent paper is 'made out of the fibre. The Hillmen recognise two species of 'this reed; they have not been scientifically distinguished, but 'further investigation will probably prove this to be the case. 'This *Beesha* seeds once every seven years. The "amma" reed, '*Beesha Rheedii* (Kunth) which is found along the river banks in 'the low country, is used for basket making. Another reed, '*Teinostachyum Wightii* (Munro) is found on the hills. It is 'supposed to flower at long intervals and did so on Peermerd in '1887-1889. Other reeds, not yet identified, are indigenous on 'the higher hills. Of grasses, the most important is the lemon 'grass *Andropogon schœnanthus*, from which an oil is extracted. As 'time goes on, other kinds will probably be found, useful for the 'manufacture of paper, and for various purposes."

The third chapter gives a detailed account of the history of the forests, which begins with the time 1817 to 1820, the first

Conservator having been a Capt. Robert Gordon. He was succeeded one by one by Mr. U. V. Munro, Mr. West, Mr. Kohlhoff and Mr. Vernède, the present Conservator having taken office on the retirement of the last-named in 1891. The old systems of management are then described, as is the work of capturing wild elephants which in Travancore devolves on the Forest Officers.

In Part II follow the 'suggestions for future management,' which begin by an interesting account of the importance of forests and of forest conservancy, go on to consider the comparative advantages of natural and artificial regeneration and those of the different systems of working. In regard to these, the conclusion arrived at is that the *selection* system is the one which it will be best and safest to adopt.

The staff which is recommended for Travancore is

	Rs.
1 Conservator Rs. 700 to 1,000 with Rs. 150 batta ...	1,000
2 Deputy Conservators and 1 Superintendent of Surveys Rs. 350 to 550 with Rs. 100 batta ...	1,650
3 Assistant Conservators Rs. 150 to 250 with Rs. 60 batta	780

with 6 Rangers @ Rs. 100, 8 Foresters @ Rs. 40, 14 Clerks @ Rs. 10 and 100 Peons and Forest Guards. @ Rs. 9.

In regard to *Finance*, it is demonstrated that hitherto the revenue has been obtained at the expense of the capital of the forests and that consequently there may be for some years a reduction in the usual yearly surplus of 3 lacs. We strongly recommend the whole Report to our readers and consider that Mr. Bourdillon, who deserves the greatest credit for it, ought to have it or at any rate the greater part of it, reprinted in a convenient size as a Forest Manual for Travancore. We congratulate him on his work and hope that the Government of His Highness the Maharaja will assist him to carry out to the full his plans for the forests of the State.

Reports on the Gardens at Saharanpur and Lucknow for 1893-94.

As usual, the Saharanpur Gardens paid their expenses during the year: they even went further and gave a surplus revenue of Rs. 947. The attempt to make the gardens financially successful has been, however, a success only at the expense of their condition as a resort, as was abundantly evident last year, for the tangled and jungly condition of the growth in the shrubberies, the weed-over-grown ponds and the dilapidated roads shewed only too clearly that financial considerations were paramount. We are glad, however, to learn from Mr. Gollan's Report that this is to be gradually remedied and that already some improvement has been effected. The chief business of the Garden is the raising and sale of fruit trees, the growing of flower and vegetable seeds, chiefly for soldiers' gardens, and the propagation of medicinal drugs, such as *Hyoscyamus*, *Taraxacum* and Jalap. Among fruits which have been successfully grown, the American Dewberry is noticeable. This plant, the *Rubus trivialis*, is a small ground trailer with a fruit like a cross between a raspberry and blackberry, it is quite successful in Saharunpore, as it is in Dehra Dun. It is best used for making jam. The edible date plantation is flourishing except that some of the plants have been attacked by the beetle *Rhyncophorus ferrugineus*. Both the Director of Agriculture and the Government of the N.-W. P. and Oudh bear testimony to the excellent work done by Mr. Gollan.

The *Lucknow* Gardens very nearly pay their expenses and on them the Government Review says :—

" They are beautifully kept and considering the high standard ' of excellence maintained from year to year it is not surprising ' that there should be a loss on their management." In the Report, however, there is not much to note which will interest our readers. The only species of *Eucalyptus* which seem to thrive are *E. tereticornis* and *E. citriodora* which are also the only two which have proved capable of growing well in Dehra Dun. The wood of the latter is being tried in the Central Prison. As with Mr. Gollan, Mr. Ridley's efforts have met with favourable notice from the Government.

VI.—EXTRACTS, NOTES AND QUERIES

A Forest Reunion in France.

The *Revue des Eaux et Forêts* for September last contains a notice of the fourth visit of the Coopers Hill Forest Students to Mortagne and the neighbouring state forests of the Perche, Reno-Valdien and Bellêm. Twelve students of the junior class under Mr. Fisher, professor of Sylviculture, were accompanied by Messrs Young and Hearle, Deputy Conservators on furlough, the latter being, as is Mr. Fisher, an old student of the Nancy Forest

School. The French Forest Officers who accompanied and made all arrangements for the party were M. Charlemagne, Conservator, Le Levreur Inspecteur, and Belliard Garde General.

The class spent some days in studying the various forests, parts of which were much admired, notably the high forest of Port-à-la-Dame where the oaks attain a height of 40 metres with trunks capable of giving a length of 32 metres of timber. The class respectfully saluted one of the finest of these trees called Tregomain's Oak in honour of the Inspecteur of this name who passed 15 years of his service in this forest and who has rendered considerable assistance to the Coopers Hill Students on several occasions. This courteous salutation of Tregomain's Oak would therefore, we doubt not, be thoroughly appreciated by the local officials.

The students also witnessed the operation, necessary in these forests, where trees are so enormous, of removing the branches or crown of an oak previous to felling. The crown comes down with a frightful crash, its fall causing a violent oscillation in the trunk left standing which is described as giving one the impression that the trunk is endeavouring to shake off the enemy attacking it. The enemy however hangs on to its sides by the aid of his rope and climbing irons. The profession of decapitator is a paying one and necessarily somewhat dangerous; the operator who performed before the English class completed his work successfully in spite of his 72 years, and having finished the operation, he seated himself in triumph on the cut cross section about 20 metres above the ground and there according to the custom of the times was photographed by one of the students.

Subsequently, the class visited and studied the forest of Lyons in which the Beech is the principal species and there the various works and provisions of the Working Plan were fully explained by the Forest Officers of the Lyons "inspection."

After visiting the forests, Mr. Fisher invited the whole party to dinner, at which entertainment the greatest cordiality and gaiety prevailed. Mr. Fisher toasted the French Forest Officers, M. Leguay the Conservator of Rouen in replying referred to the strong feeling of "camaraderie" existing between the French and English Foresters. Mr. Hearle expressed in elequent and descriptive language his admiration for the forest of Lyons and his recognition of the kindness and consideration with which the visitors had been received. Finally M. Boisset, the Mayor of Lyons, who was also of the party, drank to the health and success of the students, who then speeded the parting guests "aux cris de hip, hip, hip, hourra."!!

It is pleasant in these days of political bickering between the two nations, to find that the 'Foresters' of either can sink their national jealousies and meet in cordial friendship in the forests.

Mixed Oak and Beech Forests of the Spessart.

The vivid sketch of the magnificent hardwood reserves still remaining in the states south of the Ohio River, by Dr. Charles Mohr, of Mobile, which appeared in Garden and Forest, Volume VI, p. 21, has called to my mind the wealth of old standing oak timber in the Spessart, one of the most interesting mountain-ranges of central Germany. North American forests contain a great variety of species, whereas the forests of which I am speaking consist of two kinds only, the beech, *Fagus sylvatica*, and the oak, *Quercus sessiliflora*, the former being replaced in valleys and on low ground, exposed to night frosts, by the hornbeam *Carpinus Betulus*. The birch, maple, lime-tree, ash and wild cherry are very rare, and besides these there are only a few soft-wooded trees here and there, like the aspen and willow. Conifers have, it is true, been introduced on a large scale during the present century, and the groups of larch, the woods of Scotch pine and spruce give a greater variety to the forests but they are not indigenous in the Spessart. Again, forest trees in this portion of Germany are considerably smaller than in most of your forests. The rich soil of the valleys in the Alleghanies is said to produce yellow poplar trees 200 feet high with a trunk diameter of over ten feet whereas the tallest oak in the Spessart does not exceed 150 feet with a diameter of five feet. But, however different the aspect of forests on the two sides of the Atlantic may be, they have a point in common, the more valuable hard woods are associated with other species of little or no commercial value. In both cases, therefore, the forester has to address himself to the same difficult task, to work the forest in such a manner as not to diminish, but rather, if possible, to increase, the proportion of the more valuable kinds. An account of some of these German forests and the approved methods of regenerating them ought, therefore, to be instructive to American readers.

SPESSART—GENERAL DESCRIPTION.

The Spessart selected for illustration is in Franconia, its highest point, the Geiersberg, being 1900 feet above sea-level. The prevailing rock is new red sandstone, and the hills have rounded outlines, mostly with gentle slopes. The soil is a light, sandy loam, of itself not very fertile, but fortunately enriched by a large admixture of vegetable mould, the result of uninterrupted forest growths during thousands of years. This soil, where deep, is capable of producing tall cylindrical well-shaped stems. From the top of the Geiersberg the surrounding country present itself as a boundless sea of forest, clothing ridges and valleys almost without a break. Villages there are, but they are not numerous, and most of them are down in the valleys, and therefore concealed by the tall woods which surround them. In June, the tender, light-coloured leaves of the beech form marked contrast with the darker foliage of the oak. The picture is varied by black patches of spruce, by the bluish green of the Scotch pine, and here and there the tops of tall larch trees stand out from the rest readily distinguished by the brilliant light green of their new leaves. Game is plentiful. If you start early in the morning your are sure to come across numbers of red deer ; and wild pig, with their young, are often seen. The forest is dense and unbroken, except where fields surround the villages and narrow bands of meadows skirt the streams in the valleys.

The light sandy loam which overlies the red sandstone owes its fertility mainly to the accumulation of vegetable-mould. Unfortunately, however, a practice prevails in the greater portion of this forest district which seriously interferes with this accumulation of vegetable-mould. This is the removal of litter—the fallen leaves which cover the ground. The soil around the villages is poor, and must be manured heavily. The area of the fields is limited, and so are the meadows. Root crops can only be grown to a small extent, and the cattle must largely be fed with straw. Hence forest litter is indispensable, but by its removal, the ground gets denuded, the soil is impoverished and the forest growth suffers. Originally this practice was permitted, because the population was scanty and its hurtfulness was not fully realized. Gradually population increased, and the practice being continued unchecked, a right was acquired by prescription, and when in 1814 the forest was incorporated with the kingdom of Bavaria there was no help for it but to acknowledge the right and to regulate its exercise so as to limit the damage to the forest as much as possible.

The collection of litter has been regulated in this wise. It must not be exercised in young woods which have not yet attained half the age prescribed by the term of rotation ; further, an area where litter has been collected, must have at least six years' rest before it is again opened for that purpose, and lastly, the areas open for the collection of litter must be assigned annually by the responsible forest officers, and this is done in accordance with a well-considered plan. Nevertheless the quantity of leaves removed annually is enormous. In spring and autumn long strings of wagons filled with huge mountains of litter leave the forest in every direction, and the result is that the soil does not improve as much as it might, and in places it is much improverished.

The state forests in this part of Bavaria are also burdened with the right to dry wood, which may be exercised twice a week by the neighboring villages. May, June and July are excepted, and on the first open day in August, long before daybreak, thousands of carts and wagons enter the forest from all sides to fetch the dry wood, which it much prized, not as fuel only, but also for agricultural implements, etc. The forest is alive with men, women and children collecting what is on the ground and cutting dry standing trees. On these days the foresters have their hands full in guarding against injury to green trees. All dry wood down to three and a half inches diameter belongs to the right-holders, who may use the dry wood removed by them, but may not sell it.

Dry wood such as is removed by right-holders, is the outcome of overtopped and suppressed trees. Naturally, these are most numerous in crowded woods, whereas they are scarce in forests subject from an early age to a regular system of periodical thinnings. Hence the rule has been laid down, in order not to curtail the supply of dry wood to right-holders that no thinnings shall be made until the woods have attained half the age which they are destined to attain.

Another forest-right, but of less moment, is pannage, or the right which the inhabitants of certain villages have to feed swine upon the beech and oak mast within the forest. The exercise of this right, however, is suspended on the occurrence of a good oak mast from October to January. During that period the pannage is sold to the highest bidder, payment being generally made by the delivery of acorns collected in the forest, to be used for the extensive plantations of oak made annually by the forest Officers.

VALUE OF THE OAK.

In the Spessart, as throughout Germany, the most valuable tree is the oak. The beech and the hornbeam are useful companions; nay, they may be said to be necessary for the good development of the oak, but the value of their produce is small, An oak-tree, twenty-four inches in diameter, breast-high, and 104 feet high, will yield 5 cubic metres, or 176 cubic feet, of saleable wood, including pieces down to three inches in diameter. If sound, it will sell as follows:—Logs, fifty-five per cent. or 2.75 cubic metres at fifty marks a cubic metre, 137.50 marks. Small timber, chiefly for wine-casks, twenty per cent or 1 cubic metre at fifteen marks. Firewood, twenty-five per cent or 1. 25 cubic metres at 3.50 marks, 4.38 marks. The whole worth 156.88 marks.

A beech-tree of the same size will sell as follows: Timber thirty marks; firewood, seventy per cent for 18.50 marks, or 47.5 altogether. The timber of the hornbeam sometimes fetches a little more than beech, but the tree grows more slowly and never attains the same size as the beech. Thus assuming a dollar as equivalent to four marks, an oak-tree of the size mentioned would sell for thirty-nine dollars, and a beech-tree for twelve dollars. It must however, be borne in mind that, while an oak-tree of that size would be 300 years old, a beech-tree in the same locality would attain the same dimensions in 130 years. Many of the oak-trees in the Spessart are 400 years old and upward, and have a much larger diameter, often containing twice the volume of wood. The price of oak timber increases considerably with the diameter of the tree, large logs not rarely fetching 100 marks per cubic metre. Such trees would be worth $125 to $150 apiece, or even more. Of oak containing five cubic metres, on good soil and under favourable circumstances, sixty trees might stand on one acre. The outturn of an acre at the fall, therefore, would be worth sixty by thirty-nine or $ 2,040, while the wood of an acre stocked with beech of the same size would only be worth $720. This result, however, would be attained in 180 years, whereas the oak wood would be 300 years old.

These figures will make it clear that of the trees indigenous in the Spessart, the beech far preponderates, its growth is more vigorous and faster than that of the oak. Hence, in working the forest, the tendency will always be for the beech to gain the upper hand and for the oak to disappear. This will explain sufficiently why it is necesary to make special efforts to frame the plan of working the forest, so as gradually to increase the proportion of oak in it.

PRESENT GROWING STOCK OF OLD OAK TREES.

From time immemorial, the Spessart has been one of the principal sources of large oak timber in Western Germany. The rich wine-producing districts in the valleys of the Rhine and the Main have chiefly depended upon these forests for their wine-casks. And for boat-building and house-building the Spessart has always furnished a large quantity of oak. In spite of these constant and heavy demands, large numbers of old oak-trees from 240 to 500 years of age still remain standing. These old trees are mostly found scattered in the old beech-woods, but there are some areas where the oak forms a large proportion of the growing stock. The most remarkable of these is situated in the forest-range of Rohrbrunn, on the North-West slope of the Geiersberg, which, as already mentioned, is the highest point of this mountain-range. Here there are upward of 1,000 acres in one block, stocked with oak 240 to 245 years old at the rate of seventy trees per acre, the trees eighteen to twenty inches in diameter and ninety-five feet nigh. Among the oak, here and there, are a few beech-trees, and the ground is everywhere covered with an underwood of beech, partly natural, partly planted. These oaks date from the middle of the seventeenth century ; they sprung up soon after the thirty years war (1618-1648), and some of the mother-trees are still left, giants 500 years old, with a diameter of forty inches. This is not rapid growth, but the elevation is high 1,300 to 1,700 feet, and the soil on this slope is not very deep and not very rich.

That this is slow growth will be understood from the following figures: A survey made in August 1891 of a sample area, six-tenths of an acre, selected as a good average, gave ninety-one trees per acre, mean height ninety-five feet, tallest tree 105 feet and 8,087 cubic feet, equal to 97,000 superficial feet of timber-oak, pure, it will be remembered, with an underwood of beech, which, of course, was not included in the survey, at an elevation of 1,500 feet. In Normandy, at a low elevation, on rich soil in a mild and uniformly moist climate, there is a wood of sixty-eight acres, in the forest-range of Lyons-La-Forêt, consisting of beech sixty-five per cent, oak and hornbeam thirty per cent, and other species five per cent; sixty-eight trees per acre; mean age, 160 years, with some old standards up to 240 years old; mean height, 147 feet; tallest tree, 164 feet; volume of timber, 14,300 cubic feet, equal to 168,000 feet, broad measure.

Thus, 160 years in Normandy have produced much taller trees, and nearly twice the volume of timber per acre, than 240 years in the Spessart. The explanation is that beech grows faster than oak, as previously explained, and that soil and climate are much more favourable. These are forests in Europe in about fifty degrees of north latitude. They are beaten out of sight by the exceedingly mild and moist climate on the western slope of the coast-range in California, at about thirty-eight degrees of north latitude. Here it is reported that some redwood-forests yield 250,000 or even 500,000 feet, broad measure, per acre, and this statement does not seem incredible, for in his book on the Forests of North America, Dr. Heinrich Mayr gives an account of a sample area examined by him, with fifty-six trees per acre, mean height 275 feet, containing 190,070 cubic feet or 2,280,840 feet, broad measure. However, the age of this wood was 700 years. It would be a delightful task to manage forests with such wonderful powers of timber production. One of the first points to make for would be to determine the earliest age at which the red-wood produces marketable timber of really good quality. But even if a rotation of, say 200 years, were found to be necessary, the rent per acre of such forests, managed on conservancy principles, would be very high.

The history of this fine and valuable German Forest may be understood if we examine the forest on the eastern slope of the Geierskopf near the top, which consists entirely of an open wood of old oak-trees, over 400 years of age, with a few beech. It is generally assumed, and this assumption is borne out by such old records as exist, that 400 to 500 years ago the higher portions of the Spessart were stocked with pure or nearly pure, oak-wood.

Now, it is one of the peculiar features of pure oak-woods, a peculiarity which that tree shares with the Scotch pine the larch and other trees, which, while young, demand much light and are impatient of shade ; that as the wood grows older it gradually gets thin and open, and the canopy of its foliage no longer completely shades the ground. An oak-wood raised by broadcast sowing or the result of self-sown seedlings will, at the age of twenty years, if fully stocked, have about 1,200 stems per acre ; when 100 years old, 250 to 300 only will be left, and of them at the age of 250 years seventy only will be left on the ground. The trees which disppear during the long life of the oak-wood are overtopped and gradually die out. In the higher portions of the Spessart it is probable that, besides the natural tendency of pure oak-woods to get thin and open when old, other factors were at work in the same direction. These woods were doubtless used in summer as the high level grazing grounds by the rich villages which studded the fertile open country. The grass under the partial shelter of scattered oak-trees is excellent, and the herdsmen doubtless meant, by fire or otherwise, to get rid of a portion of the trees. The result has been that these pasture-grounds on the higher ranges of the Spessart were like a gigantic park, studded with old oak-trees, forming open woods, the ground under the trees being clothed with a dense matting of grass. During the thirty years' war, however, these villages in the open country of Franconia were repeatedly devastated, and the cattle killed or driven away ; the young oak, therefore, which until then had been kept down by the cattle, took advantage of the opportunity, and on the occurrence of the first heavy oak-mast, dense thickets of oak sprang up and covered the ground. Oak-masts do not occur frequently in the Spessart. During the fifty years from 1820 to 1870 there have only been nine heavy seed years. In spring, when the tree is in blossom, night frosts frequently prevent the fertilization of the female flowers or kill the young fruit. Caterpillars, also, not rarely destroy both young leaves and flower-buds. A good oak-mast is naturally an event of the greatest importance in the Spessart and it generally occurs once in five or six years. The acorns, being heavy, do not fall far from the tree, but in a good seed year the ground near the mother trees is covered with acorns, and the nearly pure oak woods, 240 to 245 years old, most likely owe their origin to a heavy oak-mast which occured soon after the close of the thirty year's war when there were no cattle left to eat and destroy the young seedlings.

In the forest-range of Rothenbuch which adjoins Rohrbrunn on the north, may be mentioned two smaller areas stocked with magnificent old woods of mixed oak and beech, one being the compartments Zuber and Denkstein, of 110 acres, where some 1,100 huge oaks, 375 years old are mixed with a large number of younger beeches 145 years old. The oaks are 115 feet high, with tall, clean boles, the result of having grown up closely pressed by the beech. The stand on gentle slopes with southerly aspect on the north side of the Hofenlohr valley. Higher up on the same side of that valley is the famous wood known under the name of Metzgers Graben, about 250 acres, with seven oaks per acre, from 400 to 500 years old, magnificent trees 120 to 150 feet high, mixed with beech of all ages, giving the appearance of a virgin forest, in which all age-classes are represented.

FORMER TREATMENT OF THE FORESTS.

Smaller areas of similar character are numerous, but the largest proportion of old oak-trees are found scattered among the beech-forest at the rate of less than, say, two trees per acre, and in the woods, as a rule, the beech is younger than the oak. This remarkable fact, that old oak-trees are generally associated with beech of younger age, is mainly due to the circumstance that the oak has a longer life than the beech. Besides this, however, it must be remembered that formerly more beech was cut in certain portions of this forest than oak. In those days before the time of railways, when mineral coal had not yet been brought to every town and village, wood was the only fuel used, and on account of its great heating power the beech was preferred to all other kinds. In those days, roads did not exist in the Spessart and heavy oak-timber could only be brought away from the outskirts of the forest. In the higher and inner portions, the old oak-trees remained untouched, and their chief value was to shelter the summer grazing-grounds and to yield oak-mast for the numerous herds of swine that were driven into them from the rich valleys around. In those days, the Spessart was important, not merely on account of the oak it contained, but to a much greater extent supplying fuel in the shape of beech-wood. The treatment of these woods was by selection fellings, single trees being cut out here and there, as happened to be most convenient, without interrupting the canopy. Under such a system the beech will reproduce itself readily, for beech seedlings do not demand much light while young, but rather require shelter against sun and night frost. The oak, on the other hand, demands much light while young; the necessary result, therefore, has been extensive thickets of beech, without any young oak in them. The relation between oak and beech is not everywhere the same. In other parts of Germany, where soil and climate are particularly favourable for the growth of the oak, this tree holds its own in an even-aged mixture with the beech. In the Spessart, on the other hand, the oak is overtopped and finally killed by the beech wherever they grow together in thickets and have the same age.

At a later period, glass factories were established in many places in the Spessart, which consumed fuel on a very large scale. Their demands could not be satisfied under the old system of selection fellings; clear cuttings, therefore, became the rule. From the old records it appears that in 1729 orders were issued to the effect that in all clearances a certain proportion of shelter-trees should be left to shed seed and to insure the regeneration of the fruit by self-sown seed. This was the first step toward a regular system of natural regeneration under shelter woods, a method which at a later period, has given excellent results. In these early days, however, it is probable that the seed-trees left standing were mostly old spreading trees, under whose shade the Beech came up well, while the oak had no chance. As a matter of fact, there are hardly any oak-woods in the Spessart dating from the eighteenth century. There is almost a complete break between the woods on the north-west face of the Geiersberg with oaks dating from the middle of the seventeenth century and a considerable area of oak woods in different portions of the range, now 90 to 100 years old, which date from the end of the last and the commencement of the present century. Only very small plots are found here and there with oak-trees from 100 to 150 years old. Single oak-trees of that age and younger are scattered in beech-woods of the same age but, with very rare exceptions, they have been overtopped by the beech, the stems are lank and weak, the foliage is thin; in fact, they are living but lingering, and, in many instances, dying proofs that the oak has no chance against the beech, if growing in an even-aged wood, unless the beech in the vicinity of the oak is cut back or lopped from the commencement. Attempts have been made of late years, in some places, to save such oak-poles by girdling the beeches in the vicinity. Girdled beech-trees are weakened by the operation; their foliage gets thin and ultimately, in four or five years' time, they die. This operation, however, has been futile; the remedy has come too late, and of the numerous oak-poles and under-sized oak-trees which are scattered among even-aged beech woods, very few will attain a marketable size.

OAK-WOODS UNDERPLANTED WITH BEECH.

Of the younger oak-woods, those in the vicinity of the "Weissenstein," in the Rothenbuch range, may be noted. Here are 690 acres in one block, completely stocked with oak 50 to 100 years old, with a dense underwood of beech. At an elevation of 1,500 feet, a wood in which the oak in 1891 was ninety-eight years old, was found to contain 260 stems per acre, the mean height of wood being seventy-five feet; trunk diameters, breast high, eight to ten inches, and the beech underwood twelve to twenty feet high. In the Rhine valley at a lower elevation (300 feet) and on richer soil, the oak shows a more rapid growth, attaining at that age ninety feet, with a diameter of twelve to fifteen inches. The underwood of beech in the woods last mentioned is not natural. Originally they were all nearly pure oak-woods. When forty to fifty years old, they were thinned heavily and underplanted with beech, and in places beech-nuts were sown to create an underwood of that tree. The object of this operation is to shelter the ground, and to promote the development of the oak. It has already been explained that thickets of pure oak are dense enough, but at a later stage, when the trees have attained the condition of poles, the wood becomes thin and the leaf-canopy is not sufficiently dense to shade the ground. The result is that the soil dries up and the stems become branched and irregular. The foliage of the oak, not being very dense, the leaf-fall does not enrich the soil in the same way as is the case in beech-forests. Hence the great advantage of an admixture of beech with oak. By far the most favourable condition of affairs is found where oak and beech grow up together from the commencement, provided the oak has a sufficient start so as not to be overtopped by the beech, or is protected against encroachment by lopping or cutting back the beech. When this is the case, the soil improves steadily, the oaks clear themselves at an early age of side-branches and form straight, tall, well-shaped stems. Where this has not been the case, in pure oak-woods, it is necessary at a later age to introduce the beech and to make heavy thinnings in order to enable it to grow.

SHADE-BEARING AND LIGHT-DEMANDING SPECIES.

Foresters make a distinction between trees which demand much light, such as the oak, the larch and the Scotch pine, and trees which endure much shade, such as the beech, the hornbeam, the silver fir, and, to a less extent, the spruce. The trees of the first-named class are called light-demanding; those of the second, shade-bearing. The difference between the two classes is very great and shows itself in a variety of ways. Light-demanding species are impatient of shelter while young, their foliage is light, and as explained before, woods consisting of them get thin and open when old.

On the other hand, shade-bearing trees, such as the beech and the silver fir, and to a less extent the spruce, are tender while young, being readily killed by sun and frost. These species, however, have the great advantage that they will spring up under shade, and although with an insufficient supply of light they will not make much progress; still, they will maintain themselves ready to shoot up whenever light overhead is given by the removal of shelter-trees. It follows that wood consisting of species which stand much shade can be regenerated much more easily by self-sown seed than forests composed of oak, Scotch pine and other species which demand much light. Whether natural regeneration is attempted by the selection system, that is by taking out marketable trees here and there or by the group system, or by successive cuttings spread over considerable areas, compartments or sub-compartments, success is easy in the case of shade-bearing, because a slight cutting is sufficient to induce seedlings to come up; and secondly because the young growth will continue to live under a certain amount of shade, until subsequent cuttings give more light. Again, the foliage of shade-bearing trees is dense, improving the soil by an abundant leaf-fall. Forests consisting of these species always maintain a dense canopy of leaves.

On the other hand, trees which demand much light, such as the oak and Scotch pine, spring up and thrive without much shelter; their foliage is light, and pure woods of these species get thin with age, because the weaker trees do not get light enough, and perish. In such woods, the soil gets exposed to sun and wind, and deteriorates. Hence the finest oaks are found where they have grown up in company with the beech, or with the silver fir, as is the case in some instructive and valuable woods on the borders of the Black Forest, near Rastatt, Baden-Baden and Staufen. Hence the beech has justly been called the nurse of the oak, and the same may be said of the silver fir. In this respect the Scotch pine behaves like the oak. It nowhere attains such perfection as when it grows up in company with the beech, as we find it in the Steiger Wald of Bavaria, or when it is mixed with the spruce and silver fir, as we find it in the Black Forest.

In India the Teak is a tree which demands much light. This tree also thrives best, forming straight, clean, tall stems, when associated with shady kinds, such as the bamboo. And when the forests of North America come to be studied, from a forester's point of view, or rather, when they come to be managed in a regular and permanently profitable manner, the treatment of the different species will have to be guided by analogous considerations.

In endeavoring to set before American readers the management of the mixed oak and beech forests of the Spessart, we must be prepared for the objection, that these matters may be interesting from a scientific point of view, but that they cannot possibly be of any practical utility in managing North American forests. The trees are different, the climate is different. The American forester is skilful; he is full of resource, bold and energetic. He cannot possibly be expected to have the patience to find out whether the trees of his forest are light-demanding or shade-bearing. This would take much too long, and would interfere with business. However, it may not be out of place to state here that when the writer of these lines, in 1850, discovered that teak was a light-demanding tree, he laid the foundation for the systematic management of the teak forests in Burma, which has proved successful on a large scale, and will be lasting. There is no help for it; if forest proprietors in the United States wish to leave to their children forest estates, the value of which will grow steadily, or if foresters, with a still higher aim, desire to confer lasting benefits upon their country by inaugurating a good system of forest-management, they must follow the example of foresters of Germany and other countries of Europe, and study the requirements of American forest-trees in the matter of light and shade. This is at the root of good forest-management in all countries. *D. Brandis in 'Garden and Forest.'*

Mr. Cotes' Zoology Manual.

The encouragement given to scientific instruction and research by the Indian Government is known to all who see the many interesting and important publications which issue from the different departments. Most branches of natural knowledge are fostered in India with a care which could be followed with advantage in the British Isles. The work before us is not a voluminous report, nor is it a richly illustrated monograph of the kind that often emanates from the various departments of the Government. In its way, however, it will do excellent service by providing a course of zoology suitable for the use of students at the Imperial Forest School, Debra Dun. The author, who is lecturer on Zoology in that School and Deputy Superintendent of the Indian Museum, points out that the particular animals with which the Indian Forest Officer is concerned are not treated in sufficient detail in the general text-books. His manual admirably supplies the requisite information and furnishes a sound elementary course on the classification and habies of the commoner Indian animals. The work is divided into two parts, the first of which is a systematic course, while the second consists of directions for the dissection and examination of specimens. Theory and practice are thus each given a proper share of consideration. The book is is a practical one, and the theoretical matter included in it is only such as is likely to be of use to the students for whom it has been designed. Little reference is therefore made to the fundamental theories of modern biology.—*Nature.*

VII.—TIMBER & PRODUCE TRADE

Churchill and Sim's Circular.

November 5th, 1894.

East India Teak.—The deliveries for the first ten months of the year have been 9,812 loads as compared with 11,276 loads in same period of 1893, 841 loads having been added to the consumption in October against 1,158 loads in that month last year. The demand has been feeble through the month, and the long-hoped-for improvement from the low level of current prices is still deferred.

Rosewood.—The demand is dull, but there is no unsold stock.

Satinwood.—Plain logs, unless large, are rather dull of sale, but for finely-figured wood there is a steady demand.

Ebony.—Really good parcels would find buyers at fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot, superficial	6d.	to	12d.
Rosewood	„ ton	£5.	to	£8.
Ebony	„ ton	£6.	to	£8

MARKET RATES OF PRODUCTS.

Tropical Agriculturist, November, 1894.

Cardamoms	per lb.	2s.	to	3s. 6d.
Croton seeds	per cwt.	20s.	to	27s. 6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	15s.	to	30s.
Gum Kino	„	£15	to	£18.
India Rubber, Assam,	per lb.	1s. 7d.	to	2s.
„ Burma	„	1s. 7d.	to	2s.
Myrabolams, Bombay,	per cwt.	7s. 3d.	to	9s. 3d.
„ Jubbulpore	„	6s. 3d.	to	7s.
„ Godavari	„	6s.	to	6s. 9d.
Nux Vomica, good	„	6s.	to	10s.
Oil, Lemon Grass	per lb,	1½d.		
Orchella, Ceylon	per ton	15s.	to	22s.
Redwood	„	£3. 10s.	to	£4
„	„	£3	to	£4
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	to	£30
Seed lac	„	30s.	to	90s.
Tamarinds	„	8s.	to	9s.

IX.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

23rd November, 1893—No. 1181-F.—In consequence of the return of Mr. A. E. Wild, Conservator of Forests 3rd grade, from the furlough granted him in the Notification of this Department, No. 1326-F., dated 28th October, 1892, and of the departure of Mr. J. S. Gamble, Conservator, 1st grade, School Circle, North-Western Provinces and Oudh, and Director of the Imperial Forest School at Dehra Dun, on the privilege leave granted him in Notification No. 1111-F., dated the 19th ultimo:—

(i) Mr. C. Bagshawe, Conservator, 2nd grade, Berar, is appointed to officiate in the 1st grade of Conservators.

(ii) Mr. Wild is appointed to the charge of the School Circle in the North-Western Provinces and Oudh, and of the Imperial Forest School, and to officiate in the 2nd grade of Conservators.

With effect from the 4th November, 1893, and until further orders.

20th December, 1893—No. 1281 F.—The following arrangements are ordered during the absence of Mr. B. Ribbentrop, C. I. E., Inspector-General of Forests, on the privilege leave granted him in the Notification of this Department, No. 3847—306, dated the 31st October last:—

Mr. H. C. Hill, Conservator, 1st grade, Central Circle, North-Western Provinces and Oudh—to officiate as Inspector-General of Forests.

Mr. A. E. Wild, Conservator, 3rd (officiating 2nd) grade, School Circle, North-Western Provinces and Oudh, and Director of the Imperial Forest School, Dehra Dun—to hold charge of the Central Circle, *vice* Mr. Hill, when relieved of the charge of the School Circle and the Forest School by Mr. J. S. Gamble, Conservator, 1st grade, on the return of the latter from the privilege leave granted him in Notification No. 1111 F., dated the 19th October, last.

Colonel J. E. Campbell, I. S. C., Deputy Conservator, 1st grade, North-Western Provinces and Oudh—to hold charge of the current duties of the office of Conservator of the Central Circle, from the date on which Mr. Hill receives charge of the Inspector-Generalship from Mr. Ribbentrop to the date on which Mr. Wild takes charge of the Central Circle.

2.—Madras Gazette.

8th December, 1893—Mr. C. J. Wouterss, Extra Assistant Conservator of Forests, from the South Arcot District to the Trichinopoly District.

3.—BOMBAY GAZETTE.

30th November, 1893—Messrs. E. G. Oliver and H. W. Keys, Deputy Conservators of Forests, Fourth Grade, respectively delivered over and received charge of the Divisional Forest Office, West Khándesh, on the 16th instant, before noon.

Mr. J H. Clabby, Extra Assistant Conservator of Forests, Third Grade, delivered over, and Mr. E. G. Oliver, Deputy Conservator of Forests, Fourth Grade, received charge of the Divisional Forest Office, Sholápur, on the forenoon of the 21st instant.

1st December, 1893—Mr. G. R. Duxbury, Assistant Conservator of Forests, Second Grade, newly appointed by Her Majesty's Secretary of State to the Indian Forest Service, reported himself for duty in the Northern Circle on the 30th November, 1893, before noon.

1st December, 1893—No. 8844.—Mr. Váman Rámchandra Gaundi, Extra Assistant Conservator of Forests, First Grade, and Sub-Divisional Forest Officer, Násik, is allowed furlough for three months from 1st December, 1893, or from such subsequent date as he may avail himself of it.

7th December, 1893—Mr. J. H. Clabby, Extra Assistant Conservator of Forests, Third Grade, reported himself to the Divisional Forest Officer of Poona on the 22nd November last, before office hours, and was attached to that Division for duty from that date and time.

13th December, 1893—No. 9164 —Mr. B. J. Haselden, Assistant Conservator of Forests, Second Grade, is promoted to the First Grade from 6th October, 1893.

16th December 1893—Mr. W. R. Woodrow, Deputy Conservator of Forests, resumed charge of the Dhárwár Forest Division from Mr. W. A. Talbot, Divisional Forest Officer Northern Division, Kánara, on the 8th December, 1893, before office hours.

4.—BENGAL GAZETTE.

5th December, 1893—No. 4999—Mr. E. G. Chester, Deputy Conservator of Forests, in charge of the Darjeeling Forest Division, is appointed to have charge of the Singbhum Forest Division.

Mr. H. H. Davis, Deputy Conservator of Forests, in charge of the Singbhum Forest Division, is appointed to have charge of the Darjeeling Forest Division, *vice* Mr. Chester.

11th December, 1893.—No. 5009—Consequent on the return to duty of Mr. W. M. Green, Deputy Conservator of Forests, from furlough, the following reversions are ordered in the Upper Controlling Staff of the Bengal Forest Department, with effect from the 1st November, 1893 :—

Mr. R. L. Heinig, Officiating Deputy Conservator of Forests, third grade, to revert to the fourth grade of Deputy Conservators.

Mr. W. H. Lovegrove, Officiating Deputy Conservator of Forests, fourth grade, to revert to the first grade of Assistant Conservators.

Mr. C. C. Hatt, Officiating Deputy Conservator of Forests, fourth grade, to revert to the first grade of Assistant Conservators (provisional).

12th *December*, 1893—No. 5096—Mr. W. H. Lovegrove, Assistant Conservator of Forests, on return from the privilege leave granted to him under the orders contained in Notification No. 4348 For., dated the 10th October, 1893, is posted to the Singhbhum Forest Division.

19*th* *December*, 1893—No. 5274A.—The report of the Central Examination Committee having been received, the result of the Half-yearly Departmental Examination of Assistant Magistrates and others, held in November 1893, is published for general information :—

Mr. A. H. Mee, Extra Assistant Conservator of Forests, has passed in Forest Procedure and Accounts.

5.—N. W. P. AND OUDH GAZETTE.

6*th* *December*, 1893—No. 971—The Hon'ble the Lieutenant-Governor and Chief Commissioner is pleased to declare the undermentioned gentleman to have passed the Departmental Examination for Junior Officers, held on the 23rd October, 1893, and following days, in the subjects specified below :—

Vernacular.

By Higher Standard.

Mr. F. A. Leete.

20*th* *December*, 1893—No. 3885—The undermentioned officer has been granted by Her Majesty's Secretary of State for India extension of leave :—

Name.	Service.	Appointment	Period and nature of leave.
Mr. L. Mercer ...	Forest ...	Deputy Conservator of Forests.	Special leave commuted to leave on medical certificate for 10 months.

This cancels Notification No. 3568, dated 22nd November, 1893.

6—PUNJAB GAZETTE.

8*th* *December*, 1893.—No. 116.—The words 'ditto' 'ditto' against the name of Mr. Coventry in the last column of the statement in Punjab Notifications Nos. 379 and 380 of 20th August 1892 should be omitted.

No. 620.—The following statement of the amalgamated list of Forest Officers for the Punjab, Central Provinces, Coorg and Berar, as it stood on 12th August 1892, should be substituted for that given in Punjab Notification No. 295 of 3rd May 1893 :—

Sanctioned scale.	Name of Officers.	Position of Officers.
Deputy Conservators of Forests, 1st Grade, (4).	1. J. C. McDonell	On deputation.
	2. F. B. Dickinson	Officiating Conservator of Forests.
	3. C. F. Elliott	1. Deputy Conservator of Forests, 1st Grade.
	4. J. McKee	Officiating Conservator of Forests.
Deputy Conservators of Forests 2nd Grade, (5).	5. G. G. Minniken	2. Provisional Deputy Conservator of Forests, 1st Grade.
	6. W. P. Thomas	3. Officiating Deputy Conservator of Forests, 1st Grade.
	7. G. H. Foster	4. Ditto ditto.
	8. E. Forrest	5. Deputy Conservator of Forests
	9. L. A. W. Rind	6. Ditto ditto.
Deputy Conservators of Forests, 3rd Grade, (5).	10. F. A. Lemarchand	7. Provisional Deputy Conservator of Forests, 2nd Grade.
	11. G. F. Prevost	On special leave.
	12. J. Ballantine	On deputation.
	13. E. Dobbs	8. Officiating Deputy Conservator of Forests, 2nd Grade.
	14. W. King ...	9. Ditto ditto.
Deputy Conservators of Forests, 4th Grade, (8).	15. A. M. Reuther	10. Provisional Deputy Conservator of Forests, 3rd Grade.
	16. J. H. Lace ...	11. Ditto ditto.
	17. L. G. Smith ...	12. Officiating Deputy Conservator of Forests, 3rd Grade.
	18. F. S. Barker	On furlough.
	19. H. Moore ...	Ditto. ditto.
	20. G. F. Taylor	13. Officiating Deputy Conservator of Forests, 3rd Grade.
	21. A. L. McIntire	14. Ditto ditto.
	22. H. A. Hoghton	15. Deputy Conservator of Forests, 4th Grade.
Assistant Conservators of Forests, 1st Grade, (8).	23. F. C. Hicks	16. Provisional Deputy Conservator of Forests, 4th Grade.
	24. R. J. P. Pinder	17. Ditto ditto.
	25. A. E. Lowrie	18. Officiating Deputy Conservator of Forests, 4th Grade.
	26. A. A. Watson	On sick leave.
	27. G. S. Hart ..	19 Officiating Deputy Conservator of Forests, 4th Grade.
	28. C. P. Fisher	20. Ditto ditto.
	29. A. V. Monro	On privilege leave.
	30. A. W. Blunt	21. Officiating Deputy Conservator of Forests, 4th Grade.
Assistant Conservators of Forests, 2nd Grade, (7).	31. P. H. Clutterbuck	22. Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade.
	32. A. M. F. Caccia	23. Provisional Assistant Conservator of Forests, 1st Grade.
	33. E. M. Coventry	24. Assistant Conservator of Forests, 2nd Grade.
	34. V. S. Menzies	25. Ditto ditto.
	35. H. S. K. Edie	26. Ditto ditto.
	36. C. Somers Smith	27. Ditto ditto.
	37. Vacant.	

No. 621.—To Punjab Government Notification No. 296 of 3rd May 1893 :—

Add :—

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade, with effect from 16th August 1892.

No. 622.—To Punjab Government Notification No. 298 of 3rd May 1893.—

Add—

Mr. A. M. F. Caccia, Officiating Deputy Conservator of Forests, 4th Grade, to Provisional Assistant Conservator of Forests, 1st Grade, with effect from 19th October 1892.

No. 623.— Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade, went on three months privilege leave on 6th October 1892.

No. 624.—Mr. E. M. Coventry, Assistant Conservator of Forests, 2nd Grade, was deputed to Ajmir from 1st January 1893 to 20th April 1893.

No. 625 —The following promotions to fill existing vacancies will have effect from 5th January 1893 :—

Messrs. Menzies and Edie, Assistant Conservators of Forests, 2nd Grade, to officiate as Assistant Conservators of Forests, 1st Grade.

No. 626.—Mr. V. S. Menzies, Officiating Assistant Conservator of Forests, 1st Grade, went on sick leave on 6th January 1893.

No 627.—To Punjab Government Notification No. 300 of 3rd May 1893 .—

Add—

Mr A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade, with effect from 10th January 1893.

No. 628.—Consequent on the return of Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade, from three months' privilege leave, the following reversion shall have effect from the 12th January 1893 :—

Mr. A. M F. Caccia, Officiating Deputy Conservator of Forests 4th Grade, to Provisional Assistant Conservator of Forests, 1st Grade.

No. 626.—To Punjab Government Notification No. 303 of 3rd May 1893 :—

Add—

Mr. H. S K. Edie, Officiating Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade, with effect from 27th February 1893.

No 630.—Mr. V. S. Menzies, Assistant Conservator of Forests, 2nd Grade, on sick leave, died on 21st March 1893.

No. 631.—Mr. F. B. Dickinson, Officiating Conservator of Forests, proceeded on one year's furlough from 31st March, 1893.

No. 632.—Mr. A. A. Watson, Assistant Conservator of Forests, 1st Grade, on sick leave, resigned his appointment with effect from 6th April 1893.

No. 633.—Mr. E. M. Coventry, Assistant Conservator of Forests, 2nd Grade, proceeded on examination leave for three months, with effect from 21st April 1893.

9th December 1893.—No. 639.—Mr. J. Ballantine, Deputy Conservator of Forests, 2nd Grade, on deputation, went on two years' furlough, with effect from 10th June 1893.

Mr. Ballantine still remains on deputation in His Highness the Nizam's Dominions.

No. 640.—Mr. E. M. Coventry, Assistant Conservator of Forests, 2nd Grade, returned from three months' examination leave on the 22nd July 1893.

No. 641.—Consequent on the departure of Mr. A. W. Blunt, Officiating Deputy Conservator of Forests, 4th Grade, on three months' privilege leave, the following promotions will have effect from 9th August 1893 :—

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade.

No. 642.—Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade, went on three months' privilege leave from 14th September 1893.

No. 643.—Consequent on the departure on privilege leave of Mr. L. G Smith, Provisional Deputy Conservator of Forests, 3rd Grade, and Officiating Deputy Conservator of Forests, 2nd Grade, the following promotions will have effect from 26th September 1893 :—

Mr. A. L. McIntire, Officiating Deputy Conservator of Forests, 3rd Grade, to officiate as Officiating Deputy Conservator of Forests, 2nd Grade.

Mr. A. E. Lowrie, Officiating Deputy Conservator of Forests, 4th Grade, to officiate as Officiating Deputy Conservator of Forests, 3rd Grade.

No. 644.—Consequent on the return from privilege leave of Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 3rd Grade, the following changes will have effect from 4th October, 1893.

Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 3rd Grade, to officiate as Deputy Conservator of Forests, 2nd Grade.

Mr. A. L. McIntire, Officiating Deputy Conservator of Forests, 2nd Grade, to officiate as Deputy Conservator of Forests, 3rd Grade.

Mr. A. E. Lowrie, Officiating Deputy Conservator of Forests, 3rd Grade, to officiate as Deputy Conservator of Forests, 4th Grade.

No. 645.—Consequent on the returen to duty from sick leave of Dr. Dobbs, Deputy Conservator of Forests, 3rd Grade, the following changes will have effect from 25th October, 1893 :—

Dr. Dobbs, Deputy Conservator of Forests, 3rd Grade, to officiate as Deputy Conservator of Forests, 2nd Grade.

Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 2nd Grade, to officiate as Deputy Conservator of Forests, 3rd Grade.

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade, to revert to Provisional Deputy Conservator of Forests, 4th Grade.

No. 646.—Mr. A. W. Blunt, Officiating Deputy Conservator of Forests, 4th Grade, returned on 10th November 1893 from three months' privilege leave.

No. 647.—Consequent on the departure on privilege leave for 14 days of Mr. Hoghton, Officiating Deputy Conservator of Forests, 3rd Grade, the following promotion will have effect from 12th November 1893 :—

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade, to officiate as Deputy Conservator of Forests, 3rd Grade.

No. 648.—Consequent on the return of Mr. H A. Hoghton, Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade, from privilege leave, the following reversions shall have effect from 27th November 1893 :—

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade, to Provisonal Deputy Conservator of Forests, 4th Grade.

Mr. H. S K. Edie, Officiating Deputy Conservator of Forests, 4th Grade to Officiating Assistant Conservator of Forests, 1st Grade.

12th December, 1893.—No. 652.—On return from the privilege leave of absence granted to him in *Punjab Government Gazette* Notification No. 513, dated the 9th of October 1893, Mr. G. S. Hart, Officiating Deputy Conservator of Forests, resumed charge of the Simla Hill Tracts Division on the forenoon of the 13th November 1893, relieving Mr. G G. Minniken, Deputy Conservator of Forests.

16th December 1893. No. 665.—In Punjab Notification No. 381 of 20th August 1892, omit the words "Mr. L. G. Smith, Officiating Deputy Conservator of Forests, 3rd Grade, to be Deputy Conservator of Forests, 3rd Grade, substantive provisional."

No. 666.—To Punjab Government Notification No. 302 of 3rd May 1893 add—

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade, with effect from 26th February 1893.

No. 667.—Consequent on the death of Mr. G. H. Foster, Officiating Deputy Conservator of Forests, 1st Grade, the following promotions will have effect from 29th April, 1893 :—

Mr. L. A. W. Rind, Deputy Conservator of Forests, 2nd Grade, to officiate as Deputy Conservator of Forests 1st Grade ;

Mr. F. O. Lemarchand, Provisional Deputy Conservator of Forests, 2nd Grade, to be Deputy Conservator of Forests, 2nd Grade ;

Mr. G. F. Prevost, Officiating Deputy Conservator of Forests, 2nd Grade, to be Provisional Deputy Conservator of Forests, 2nd Grade ;

Mr. A. M. Reuther, Provisional Deputy Conservator of Forests, 3rd Grade (on furlough), to be Deputy Conservator of Forests, 2nd Grade ;

Mr. L. G. Smith, Officiating Deputy Conservator of Forests, 2nd Grade, to be Provisional Deputy Conservator of Forests, 3rd Grade, and to continue to officiate as Deputy Conservator of Forests, 2nd Grade;

Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 3rd Grade, to officiate as Deputy Conservator of Forests, 2nd Grade ;

Mr. A. F. Lowrie, Officiating Deputy Conservator of Forests, 4th Grade, to officiate as Deputy Conservator of Forests, 3rd Grade.

No. 668.—Consequent on Mr. Somers Smith's promotion to the 1st Grade of Assistant Conservators in accordance with Punjab Government Notification No. 605 of 28th November 1893, the following list is published showing the names and positions of officers on the 2nd of May, 1893 :—

Serial No.	Names.	Position.
Deputy Conservators of Forests, 1st Grade (4).	1 J. C McDonell ...	On deputation.
	2 F. B. Dickinson ...	On furlough.
	3 C. F. Elliott ...	Officiating Conservator of Forests
	4 J. McKee ...	Ditto ditto.
Deputy Conservators of Forests, 2nd Grade (5).	5 G. G. Minniken ...	1. Provisional Deputy Conservator of Forests, 1st Grade.
	6 W. P. Thomas ...	2. Officiating Deputy Conservator of Forests, 1st Grade.
	7 E. Forrest ...	3. Ditto ditto.
	8 L. A. W. Rind ...	4. Ditto ditto.
	9 F. O. Lemarchand.	5. Deputy Conservator of Forests, 2nd Grade.
Deputy Conservators of Forests, 3rd Grade (5).	10 G. F. Prevost ...	6. Provisional Deputy Conservator of Forests, 2nd Grade.
	11 J. Ballantine ...	On deputation.
	12 E. Dobbs ...	On sick leave.
	13 W. King ...	7. Officiating Deputy Conservator of Forests, 2nd Grade.
	14 A. M. Reuther ...	On furlough.
Deputy Conservators of Forests, 4th Grade (8).	15 J. H. Lace ...	Ditto.
	16 L. G. Smith ...	8. Provisional Deputy Conservator of Forests, 3rd Grade, and Officiating Deputy Conservator of Forests, 2nd Grade.
	17 F. S Barker ...	On sick leave.
	18 H. Moore ...	On furlough.
	19 G. F. Taylor ..	9. Officiating Deputy Conservator of Forests, 2nd Grade.
	20 A. L. McIntire ...	10. Officiating Deputy Conservator of Forests, 3rd Grade.
	21 H. A. Hoghton ...	11. Ditto ditto.
	22 Vacant ...	
Assistant Conservators of Forests, 1st Grade (8).	23 F. C. Hicks ...	12. Provisional Deputy Conservator of Forests 4th Grade, Officiating Deputy Conservator of Forests, 3rd grade.
	24 R. J. P. Pinder ...	13. Provisional Deputy Conservator, 4th Grade, Officiating Deputy Conservator of Forests, 3rd Grade.
	25 A. E. Lowrie ...	14. Officiating Deputy Conservator of Forests, 3rd Grade.
	26 C. Somers Smith...	15. Officiating Deputy Conservator of Forests, 4th Grade.
	27 G. S. Hart ...	16. Ditto ditto.
	28 C. P. Fisher ...	17. Ditto ditto.
	29 A. V. Monro ...	18. Ditto ditto.
	30 A. W. Blunt ...	19. Ditto ditto.

Serial No.	Names.	Position.
Assistant Conservators of Forests, 2nd Grade (7).	31 P. H. Clutterbuck	20. Provisional Assistant Conservator of Forests, 1st Grade, Officiating Deputy Conservator of Forests, 4th Grade.
	32 A. M. F. Caccia ..	21. Ditto ditto.
	33 E. M. Coventry ...	On examination leave.
	34 H. S. K. Edie ...	22. Officiating Deputy Conservator of Forests, 4th Grade.
	35 Vacant.	
	36 Ditto.	
	37 Ditto.	

No. 669 – Consequent on the reversion of Mr. C. F. Elliott, Officiating Conservator, to his substantive appointment, the following reversions shall have effect from the 26th May 1893 :—

Mr L. A. W. Rind, Officiating Deputy Conservator of Forests, 1st Grade, to Deputy Conservator of Forests, 2nd Grade ;

Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 2nd to Officiating Deputy Conservator of Forests, 3rd Grade ;

Mr. A. E. Lowrie, Officiating Deputy Conservator of Forests, 3rd Grade, to Officiating Deputy Conservator of Forests 4th Grade ;

Mr. H S. K. Edie, Officiating Deputy Conservator of Forests, 4th Grade, to Officiating Assistant Conservator of Forests, 1st Grade.

No. 670.—Consequent on Mr. H. Calthrop's joining Berar from Burma from the 21st July 1893, the following statement showing the names and position of officers on the amalgamated list is published:—

No.	Names.	Position.
Deputy Conservators of Forests, 1st Grade (4.)	1. J. C. McDonnell	On deputation.
	2. F. B. Dickinson	On furlough.
	3. C. F. Elliott	Deputy Conservator of Forests, 1st Grade.
	4. J. McKee	Officiating Conservator of Forests.
Deputy Conservators of Forests, 2nd Grade (5.)	5. G. G. Minnniken	Provisional Deputy Conservator of Forests, 1st Grade.
	6. W. P. Thomas	Officiating Deputy Conservator of Forests, 1st Grade.
	7. E. Forrest	Ditto ditto.
	8. L. A. W. Rind	Deputy Conservator of Forests, 2nd Grade.
	9. F. O. Lemarchand	Ditto. ditto.
Deputy Conservators of Forests, 3rd Grade (5.)	10. G. F. Prevost	Provisional Deputy Conservator of Forests, 2nd Grade.
	11. J. Ballantine	On Deputation (on furlough.)
	12. E. Dobbs	On sick leave.
	13. W. King	Officiating Deputy Conservator of Forests, 2nd Grade.
	14. A. M. Reuther	On furlough.

No.	Names.	Position.
Deputy Conservators of Forests, 4th Grade (8.)	15. J. H. Lace	On furlough.
	16. L. G. Smith	Provisional Deputy Conservator of Forests, 3rd Grade and Officiating Deputy Conservator of Forests, 2nd Grade.
	17. F. S. Barker	On sick leave.
	18. H. Moore	On furlough
	19. G. F. Taylor	Officiating Deputy Conservator of Forests, 3rd Grade.
	20. A. L. McIntire	Ditto. ditto.
	21. H. A. Hoghton	Ditto. ditto.
	22. H. Calthrop	Ditto. ditto.
Assistant Conservators of Forests, 1st Grade (8.)	23. F. C. Hicks	Provisional Deputy Conservator of Forests, 4th Grade, Officiating Deputy Conservator of Forests, 3rd Grade.
	24. R. J. P. Pinder	Provisional Deputy Conservator of Forests, 4th Grade.
	25. A. E. Lowrie	Officiating Deputy Conservator of Forests, 4th Grade.
	26. C. Somers Smith	Ditto. ditto.
	27. G. S. Hart	Ditto. ditto.
	28. C. P. Fisher	Ditto. ditto.
	29. A. V. Monro	Ditto. ditto.
	30. A. W. Blunt	Ditto. ditto.
Assistant Conservators of Forests, 2nd Grade (7.)	31. P. H. Clutterbuck	Provisional Assistant Conservator of Forests, 1st Grade, Officiating Deputy Conservator of Forests, 4th Grade.
	32. A. M. F. Caccia	Provisional Assistant Conservator of Forests, 1st Grade.
	33. E. M. Coventry	On examination leave.
	34. H. S. K. Edie	Officiating Assistant Conservator of Forests, 1st Grade.
	35. Vacant.	
	36. Vacant.	
	37. Vacant.	

No. 671.—Consequent on the departure on privilege leave of Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 3rd Grade, the following promotions will have effect from 10th August 1893 :—

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade, to officiate as Deputy Conservator of Forests, 3rd Grade ;

Mr. H. S. K. Edie, Officiating Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade.

No. 672.—Consequent on the return from furlough of Mr. H. Moore, Deputy Conservator of Forests, 4th Grade, the following promotions and reversions will have effect from 22nd August, 1893 :—

Mr. H. Moore, Deputy Conservator of Forests, 4th Grade, to officiate as Deputy Conservator of Forests, 3rd Grade ;

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade, to Provisional Deputy Conservator of Forests, 4th Grade ;

Mr. H. S. K. Edie, Officiating Deputy Conservator of Forests, 4th Grade, to Officiating Assistant Conservator of Forests, 1st Grade.

No. 673.—Consequent on the departure on privilege leave of Mr. F. O. Lemarchand, Deputy Conservator of Forests, 2nd Grade, the following promotions will have effect from 8th September, 1893: —

Mr. H. Moore, Officiating Deputy Conservator of Forests, 3rd Grade, to officiate as Deputy Conservator of Forests, 2nd Grade;

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade, to officiate as Deputy Conservator of Forests, 3rd Grade;

Mr. H. S K. Edie, Officiating Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade.

22nd December, 1893 —No 690.—Mr. A. M. Reuther, Deputy Conservator of Forests, reported his return from the furlough granted him in Punjab Government Notification No. 164, dated 8th March, 1893, on the forenoon of the 15th December 1893, and assumed charge of the Working Plans Division with effect from that date.

7.—Central Provinces Gazette.

7th December 1893.—No. 5718.—Mr. H. A. Hoghton, Deputy Conservator of Forests, Seoni, availed himself, on the afternoon of the 11th November 1893, of the fourteen days' privilege leave granted him by Notification No. 5007, dated the 26th October 1893, making over charge of his duties to the Deputy Commissioner, Seoni.

20th December No. 5975 —With reference to Notification No. 5131, dated the 2nd November 1893, Mr. H. Moore, Deputy Conservator of Forests, assumed charge of the Betul Forest Division from Mr. R. C. Thompson, Extra-Assistant Conservator of Forests, on the forenoon of the 24th idem.

2nd November, No. 5981.—Mr. H. A. Hoghton, Deputy Conservator of Forests, Seoni, returned from the fourteen days' privilege leave granted by Notification. No. 5007, dated the 26th October 1893, and, assumed charge of his duties from the Deputy Commissioner, Seoni, on the forenoon of the 27th November 1893.

8.—Burma Gazette.

25th November, 1893 —No. 31.—Mr. T. H. Aplin, Deputy Conservator of Forests, reported his return from the three months and fifteen days' privilege leave granted to him in the Revenue Department Notification No. 285 (Forests), dated the 2nd August 1893, and resumed charge of the Lower Chindwin Forests division, and of the Mingin subdivision of that division from Mr. C. W. A. Bruce, Officiating Deputy Conservator of Forests, on the forenoon of the 20th November 1893.

No. 32.—With reference to Revenue Department Notification No. 455 (Forests), dated 15th November 1893, Mr. A. M. Burn-Murdoch, Assistant Conservator of Forests, made over, and Mr. J. W. Thellusson, Deputy Conservator of Forests, assumed, charge of the Minbu division on the forenoon of the 18th November 1893.

No 83.—With reference to Revenue Department Notification No. 463 (Forests), dated the 23rd November 1893, Mr. C. W. Allan. Extra Assistant Conservator of Forests, attached to the Yaw division, on general duty, made over charge of his duties to Mr. D. L. K. Calderwood, Extra Assistant Conservator of Forests, Gangaw subdivision, Yaw division, on the afternoon of the 7th November 1893, and reported his arrival at the headquarters of the Upper Chindwin division on the 12th idem.

28th November, No. 284.—At the Departmental Examination held at Moulmein, Katha, Bhamo, Monywa, and Meiktila, on the 2nd November 1893, the following Forest Officers passed in the subjects specified opposite their names according to the standards prescribed for the examination for Forest Officers in Chapter IV of the Departmental Examination Rules :—

Name.		*Passed in*
Mr. C. R. Dun, Assistant Conservator...		Procedure and Accounts.
Mr. C. Ingram	Extra Assistant Conservators.	Law, Revenue, and Procedure and Accounts.
Mr. D. L. K. Calderwood		Procedure and Account
Mr. W. J. Lane-Ryan		Law and Revenue.
Mr. R. F. Lowis		Revenue.
Mr. W. A. Hearsey		Procedure and Accounts.
Mr. R. M. Kavanagh		Procedure and Accounts.
Mr. C. S. Rogers	Forest Rangers.	Law and Procedure and Accounts.
Mr. H. D. Allan		

1st December, 1893.—No. II.—With reference to Revenue Department Notification No. 455, dated the 15th November 1893, Mr. W. T. T. McHarg, officiating Deputy Conservator of Forests, and Mr. C. R Dun, Assistant Conservator of Forests, respectively made over and received charge of the Bhamo division on the afternoon of the 27th November 1893.

4th December 1893.—No. 480.—On his return from leave Mr. C. W B. Anderson, Extra Assistant Conservator of Forests, is posted to the charge of the Revenue subdivision, Mandalay Forest division.

No. 481.—Mr. R. M. Kavanagh is transferred from Mandalay to the charge of the Myadaung subdivision, Katha Forest division.

7th December 1893 —No. 484.—The undermentioned officers have been permitted by Her Majesty's Secretary of State for India to return to duty within the period of their leave :—

Mr. E. S. Carr, Deputy Conservator of Forests.

Mr. H. Carter, Assistant Conservator of Forests.

8th December 1893.—No. 486.—Mr. C. B. Smales, who has been appointed by the Secretary of State for India to be an Assistant Conservator of Forests in Burma, reported his arrival in Rangoon on the 6th December 1893, afternoon.

Mr. Smales is posted to the Lower Chindwin Forest division.

8th December, 1893.—No. 34.—With reference to Revenue Department Notifications Nos 386, 388 and 390 (Forests), dated the 4th October 1893, Mr. A. S Fleming, I. C. S., Deputy Commissioner, reported his arrival at Monywa for Forest Settlement duty on the forenoon of the 3rd December 1893.

9th December, 1893.—No. 487.—The following temporary alterations of rank are ordered in the Forest Department:—

(1) With effect from the 9th November 1893, the date on which Mr. Palmer, Deputy Conservator of Forests, availed himself of leave—

Mr. C. H. Hobart-Hampden, Deputy Conservator, 4th, officiating 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. F. J. Branthwaite, Assistant Conservator, 1st, officiating Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. G R. Long, Assistant Conservator 2nd, officiating 1st grade, to officiate as Deputy Conservator, 4th grade.

(2) With effect from the 13th November 1893, the date on which Mr. Toussaint, Deputy Conservator of Forests, 4th, officiating 3rd grade, returned from leave—

Mr. F. J. Branthwaite. Assistant Conservator, 1st, officiating Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 4th grade.

Mr G. R. Long, Assistant Conservator, 2nd, officiating Deputy Conservator, 4th grade, to officiate as Assistant Conservator, 1st grade.

(3) With effect from the 17th November 1893, the date on which Mr. J. Copeland, Deputy Conservator of Forests, returned from leave—

Mr. J Copeland, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. C. H Hobart-Hampden, Deputy Conservator 4th, officiating 2nd grade, to officiate as Deputy Conservator, 3rd grade.

Mr. G. F. R. Blackwell, Deputy Conservator, 4th, officiating 3rd grade, to revert to his substantive appointment.

Mr. H. H. Forteath, Assistant Conservator, 2nd, officiating Deputy Conservator, 4th grade, to officiate as Assistant Conservator, 1st grade.

(4) With effect from the 18th November 1893, the date on which Mr. Thellusson, Deputy Conservator of Forests, returned from leave—

Mr. F. W. Thellusson, Deputy Conservator, 2nd, to officiate as Deputy Conservator, 1st grade.

Mr. H. Slade, Deputy Conservator, 2nd, officiating 1st grade, to revert to his substantive appointment.

Mr. H. B. Anthony, Deputy Conservator, 4th, officiating 2nd grade, to officiate as Deputy Conservator, 3rd grade.

Mr. C. L Toussaint, Deputy Conservator, 4th, officiating 3rd grade, to revert to his substantive appointment.

Mr. H. N. Thompson, Assistant Conservator, 2nd, officiating Deputy Conservator, 4th grade, to officiate as Assistant Conservator, 1st grade.

Mr. J. Messer, Assistant Conservator, 2nd. officiating Deputy Conservator, 4th grade, to officiate as Assistant Conservator, 1st grade.

(5) With effect from the 20th November, the date on which Mr. Aplin, Deputy Conservator of Forests, 2nd, officiating 1st grade, returned from leave—

Mr F. W. Thellusson, Deputy Conservator, 2nd officiating 1st grade, to revert to his substantive appointment.

Mr. J. Copeland, Deputy Conservator, 3rd, officiating 2nd grade, to revert to his substantive appointment.

Mr. H Jackson, Deputy Conservator, 4th, officiating 3rd grade, to revert to his substantive appointment.

Mr. C. W. A. Bruce, Assistant Conservator, 1st, officiating, Deputy Conservator, 4th grade, to revert to his substantive appointment

11*th December* 1893.—No. 481,—The following postings and transfers are ordered in the Forest Department :—

Mr F. J. Branthwaite, officiating Deputy Conservator of Forests, is transferred as a temporary measure from the Working Plans division to the Tharrawaddy division.

Mr. H Carter, Assistant Conservator of Forests, on his return from leave, is posted to the charge of the Working Plans division.

On being relieved by Mr. Hauxwell of the charge of the Salween-Attaran division, Mr. J. Messer, Assistant Conservator of Forests, is posted as a temporary measure to the Toungoo division.

12*th December*, 1893.—No. 35 —With reference to Revenue Department Notification No. 463 (Forests), dated the 23rd November 1893, Mr. H. H. Forteath, officiating Deputy Conservator of Forests, reported his arrival at the headquarters of the Upper Chindwin division on the forenoon of the 28th November, 1893.

No. 36.—Mr. C. W. Allan, Extra Assistant Conservator of Forests, Upper Chindwin division, assumed charge of the Kindat Revenue subdivision of that division on the forenoon of the 2nd December, 1893.

No. 37.—With reference to Revenue Department Notification No. 455 (Forests), dated the 15th November 1893, Mr. W. T. T. McHarg, officiating Deputy Conservator of Forests, reported his arrival at the headquarters of the Lower Chindwin division on the forenoon of the 6th December, 1893.

9.—ASSAM GAZETTE.

30*th November*, 1893.—No. 11,303G.—In consequence of the death of Mr. J. C. Kelly, Extra Assistant Conservator of Forests, First Grade, Babu Tara Kisor Gupta, Extra Assistant Conservator of Forests, Fourth Grade, is promoted to the Third Grade of Extra Assistant Conservators with effect from the 29th May 1893.

7*th December*, 1893.—No. 11,548G.—Mr. F. E. B. Lloyd, who has been appointed by Her Majesty's Secretary of State to the Forest Department in Assam, having reported his arrival in India, is attached to the Goalpara Forest Division, *7th December*, 1893.—No 11,597G.—In continuation of Notification No. 11,321G., dated the 1st December 1893, the Chief Commissioner directs, on the report of the Central Examination Committee, the publication of the results of the Half-yearly Examination held on the 14th, 15th, and 16th November, 1893, of the Forest Officer named below :

Name.	Subjects taken up by the Candidate.		Subjects in which passed.		Compulsory Subjects in which still required to pass.	
	Higher Standard.	Lower Standard.	Higher Standard.	Lower Standard.	Higher Standard.	Lower Standard.
Mr. A. M. Long, Assistant Conservator of Forests.	Assamese, Procedure & Accounts.		Procedure and Accounts.		Assamese.	

10.—HYDERABAD RESIDENCY GAZETTE.

24th November, 1893.—No. 361.—Mr. B. Bhukan, Extra Assistant Conservator of Forests, is transferred temporarily from the Buldana to the Ellichpur Forest Division, and Mr. Bisessar Singh, Forest Ranger, is placed, as a temporary measure, in charge of the Buldana Division.

28th November, 1893.—No. 362.—The Resident is pleased to declare that Mr. E. M. Coventry, an Assistant Conservator of Forests in the Hyderabad Assigned Districts, has passed with credit the examination in Procedure and Accounts prescribed for Assistant Conservators in sections 72 and 78 of the Forest Department Code.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

2nd January, 1894.—No. 1-F.—The undermentioned officers, who have been appointed by Her Majesty's Secretary of State to the Forest Department of India, are appointed to be Assistant Conservators of the 2nd grade, with effect from the dates specified opposite their names, and are posted to the Provinces noted below :—

Mr H. G. Billson, North-Western Provinces and Oudh, 27th November, 1893.
„ C. C. Abbey, North-Western Provinces and Oudh, 20th November, 1893.
„ R. M. Williamson, Berar, 16th November, 1893.
„ R. C. Milward, Central Provinces, 27th November, 1893.
„ F. Linnell, Central Provinces, 27th November, 1893.
„ C. O Hanson, Central Provinces, 27th November, 1893.
„ W. F. Perrée, Bengal, }
„ C. B Smales, Burma, } 1st December, 1893.
„ E. P. Stebbing, Bengal, }
„ E. E. B. Lloyd, Assam, }

10th January, 1894.—No. 45-F.—The following transfer is ordered in the interests of the public service :—

Mr. H. S. K. Edie, Assistant Conservator of Forests, Central Provinces—to Assam.

12th January, 1894.—No. 57-F—On return from the privilege leave granted in the Notification of this Department, No. 1111 F., dated the 19th October last, Mr. J. S Gamble, Conservator of Forests, 1st grade, resumed charge, from Mr. A. E. Wild, Conservator, 3rd (officiating 2nd) grade, of the School Circle, North-Western Provinces and Oudh, and of the Directorship of the Imperial Forest School, Dehra Dun, with effect from 4th January, 1894.

No. 61-F.—The following transfer is ordered in the interests of the public service :—

Mr. E. M. Coventry, Assistant Conservator of Forests, Berar,—to the Punjab.

12th January 1894—No. 52 Home Department (*Public*).—It is hereby notified for general information that the undermentioned officers will take rank in the third class of the Supplementary Graded List of Civil Officers not reserved for members of the Civil Service of India, published with the Warrant of Precedence for India in Home Department Notification No. 2032, dated the 1st November 1877, that is to say, in Article 77 of the said Warrant.

Deputy Conservators of Forests, drawing a salary of Rs. 800 a month and over.

Assistant Inspector-General of Forests.

Deputy Director of the Imperial Forest School.

2.—MADRAS GAZETTE.

20th December, 1893.—The three months' leave to Ranger Narayanaswami Aiyar notified at page 1282, Part II of the *Fort St. George Gazette*, dated 12th September 1893, is extended by three months, *i. e.*, until 1st March 1894.

28th December, 1893.—The acting promotions of R. Balaji Singh and A. P. Ramachendra Mudaliar as Rangers, 4th and 5th Grades, respectively, notified at page 1506, Part II of the *Fort St. George Gazette*, dated 24th October 1893, are to continue until 1st March 1894 during Ranger Narayanaswami Aiyar's absence on leave.

Promotion.—T. Arumuga Mudaliar, Acting Forester, 1st Grade North Arcot, to be Ranger, 5th Grade, with effect from 15th October 1893.

4th January, 1894.—No. 17.—Postings of Forest Officers.

No.	Names of officer.	District.	Nature of charge.	Remarks.
1	Mr. J. G. F. Marshall, Extra Assistant Conservator of Forests, 1st Grade.	North Malabar Division.	District Forest Officer.	Transfers to take effect from date of Mr. Eber Hardie's taking furlough.
2	Mr. C. D. McArthy, Assistant Conservator of Forests, 1st Grade.	North Arcot...	Do.	
3	Mr. V. Alwar Chetty, Extra Assistant Conservator of Forests, 2nd Grade.	Vizagapatam..	Do.	
4	Mr. J. H. B. Brougham, Deputy Conservator of Forests 3rd Grade.	Nellore ..	Do.	Confirmation of acting District Forest Officers,
5	Mr. H. B. Bryant, Assistant Conservator of Forests, 1st Grade.	South Coimbatore	Do.	
6	Mr. J. L MacC. O'Leary, Assistant Conservator of Forests, 2nd Grade.	Kistna ..	..	To do duty under the District Forest Officer, Kistna.

8th January 1894.—One month's leave, on forfeiture of pay granted to T. Subramania Mudaliar, Temporary Forest Surveyor, Bellary, in office order No. 74 of 1893-94, is cancelled.

8th January 1894.—No. 1.—Mr. C. A. Eber Hardie, District Forest Officer, North Malabar, is granted furlough for one year, with effect from or after 1st February 1894, under article 371 of the Civil Service Regulations.

16th January 1894.—No. 10.—

No.	Name and designation of officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. R. McIntosh, District Forest Officer, Cuddapah.	Assistant Conservator of Forests, 1st Grade.	Deputy Conservator, 4th Grade.	Permanent.	With effect from 18th January 1894.
2	Mr. A.B. Jackson, District Forest Officer, Godavari.	Do.	Do.	Do. ..	Do.

16th January 1894.—Mr. T. N. Hearsey, Acting District Forest Officer, Anantapur, will, on relief by Mr. Murray, from Karnool, proceed and take charge of the Sub-Division, Kurnool District, with head-quarters at Nandyal.

18th January 1894.—The leave of absence to Ranger M. Jambunatha Sastri, notified at page 1749, Part II, of the *Fort St. George Gazette*, dated 19th December 1893, is extended to 27th January 1894.

3.—BOMBAY GAZETTE.

6th January, 1894.—Mr. L. S. Osmaston, Assistant Conservator of Forests, First Grade, reported himself for duty on Working Plans to the undersigned on the 19th December 1893, in the afternoon, as directed in Government Resolution No. 9161, dated 13th December 1893, Revenue Department, and was attached to the Conservator's office, Central Circle.

11th January, 1893.—Messrs. W. R. Gaunde, Extra Assistant Conservator of Forests, First Grade, and V. G Tumné respectively delivered over and recieved charge of the Sub-Division Office, Násik, on the 12th December last, after office hours.

10th January, 1894.—No. 223.—Mr. G. A. Hight, Deputy Conservator of Forests, Second Grade, has been allowed by Her Majesty's Secretary of State for India an extension of furlough for six months.

No. 238.—Mr. E. G Oliver, Divisional Forest Officer, Sholápur, passed an examination in Maráthi on 5th January 1894.

4.—BENGAL GAZETTE.

10th January, 1894.—No. 168.—In continuation of Notification No. 4394 For., dated the 28th October 1893, it is hereby notified that Mr. F. Trafford, Assistant Conservator of Forests, has been granted a further extension of leave for one month on medical certificate by the Secretary of State.

5.—N. W. P. AND OUDH GAZETTE.

9th January, 1894.—No. 87—II—392C·—Mr. N. Hearle, Deputy Conservator of Forests, in charge of the Dehra Dún Forest Division, furlough out of India for ten months, with effect from the 1st February 1894.

9th January, 1894 —No. 88.—II. 392C.—Pandit Sadanand, Extra Assistant Conservator of Forests, attached to the Jaunsar Forest Division, to the charge of the Dehra Dún Forest Division as a temporary measure.—

19th January, 1894.—No. 201.—II. 403C·—Mr. A. G. Hobart-Hampden, Deputy Conservator of Forests, in charge of the Kumaun Forest Division of the Central Circle, privilege leave for thirty days, with effect from the 25th January 1894.

19th January, 1894.—No. 202.—II. 403C.—Mr. F. B. Bryant, Deputy Conservator of Forests, and Working Plans Officer, Central Circle, to hold charge of the Kumaun Forest Division of the Central Circle, in addition to his own duties, during the absence on leave of Mr. A. G. Hobart-Hampden, or until further orders.

6.—Punjab Gazette.

3rd *January*, 1894.—No. 1.—On return from the three months, privilege leave granted to him in *Punjab Government Gazette* Notification No. 422, dated 5th of August 1893, Mr. F. O. Lemarchand, Deputy Conservator of Forests, resumed charge of the Kángra Forest Division on the afternoon of the 7th December 1893, relieving Mr. C. Somers Simth, Assistant Conservator of Forests, who will remain attached to the Kángra Division till further orders.

6th *January* 1894.—No. 12.—Punjab Government Notification No. 622, dated 8th December 1893, is hereby cancelled.

6th January, 1894.—No. 13.—To Punjab Government Notification No. 299, dated 3rd May 1893, *add*—

Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade (on privilege leave), to Provisional Assistant Conservator of Forests, 1st Grade:

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade. and Officiating Deputy Conservator of Forests, 4th Grade, to Provisional Assistant Conservator of Forests, 1st Grade, with effect from 16th December 1892.

6th January, 1894.—No. 14.—To Punjab Government Notification No. 300, dated 3rd May 1893, *add*—

Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st Grade, on privilege leave, to officiate as Deputy Conservator of Forests, 4th Grade, with effect from 10th January 1892.

6th January, 1894.—No. 15.—To Punjab Government Notification No. 643, dated 9th December 1893, *add*—

Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 3rd Grade (on privilege leave), to be Officiating Deputy Conservator of Forests, 2nd Grade, with effect from 26th September 1893.

6th January, 1894.—No. 16.—In Punjab Government Notification No. 644, dated 9th December 1893, *for* "Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 3rd Grade," *read* "Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 2nd Grade," and omit the words "Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 3rd Grade, to officiate as Deputy Conservator of Forests, 2nd Grade.

6th January 1894.—No. 17.—To Punjab Government Notification No. 648, dated 9th December 1893, *add*—

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade, (on privilege leave), to Provisional Assistant Conservator of Forests, 1st Grade, with effect from 27th November 1893.

6th January. 1894.—No. 18.—Consequent on the return of Mr. F. O Lemarchand, Deputy Conservator of Forests, 2nd Grade, the following reversions will have effect from 8th December 1893:—

Mr. L. G. Smith, Provisional Deputy Conservator of Forests, 3rd Grade, and Officiating Deputy Conservator of Forests, 2nd Grade (on privilege leave), to Provisional Deputy Conservator of Forests, 3rd Grade;

Mr. H. Moore, Officiating Deputy Conservator of Forests, 2nd Grade, to Officiating Deputy Conservator of Forests, 3rd Grade :

Mr. F. C Hicks, Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade, to Provisional Deputy Conservator of Forests, 4th Grade ;

Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade, to Provisional Assistant Conservator of Forests, 1st Grade.

6th January, 1894 —No. 19.—With reference to Punjab Government Notification No. 642, dated 8th December 1893, Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests 1st Grade, returned from three months' privilege leave on the 14th December 1893.

6th January, 1894.—No. 20.—Consequent on the return from furlough of Mr. A. M. Reuther, Deputy Conservator of Forests, 3rd Grade, the following reversions shall have effect from 15th December 1893 :—

Mr. H. Calthrop, Officiating Deputy Conservator of Forests, 3rd Grade, to Deputy Conservator of Forests, 4th Grade ;

Mr. A. W. Blunt, Officiating Deputy Conservator of Forests, 4th Grade, to Assistant Conservator of Forests, 1st Grade.

6th January, 1894 —No. 24.— In Punjab Government Notification No. 667, dated 16th December 1893, *for* "Mr. A. M. Reuther, Provisional Deputy Conservator of Forests, 3rd Grade, on furlough, to be Deputy Conservator of Forests, 2nd Grade," *read* "Mr. A. M. Reuther Provisional Deputy Conservator of Forests, 3rd Grade, (on furlough), to be Deputy Conservator of Forests, 3rd Grade."

19th January, 1894.—No. 51.—In Punjab Government No. 14 dated 6th January 1894, *for* "10th January 1892" *read* "10th January 1893."

19th January, 1894.—No. 52.—In Punjab Government Notification Nos. 13, 14 and 18, dated 6th January 1895, *for* "Mr. P. H. Clutterbuch" *read* "Mr. P. H. Clutterbuck."

19th January, 1894.—No. 53.—Consequent on the return of Mr. L Gisborne-Smith, Provisional Deputy Conservator of Forests, 3rd Grade, from privilege leave, the following reversions shall have effect from 26th December 1893 :—

Mr. H. A. Hoghton, Officiating Deputy Conservator of Forests, 3rd Grade, to Deputy Conservator of Forests, 4th Grade.

Mr. A. V. Monro, Officiating Deputy Conservator of Forests, 4th Grade, to Assistant Conservator of Forests, 1st Grade.

19th January, 1894.—No. 54.—Mr. H. S. K. Edie, Officiating Assistant Conservator of Forests, 1st Grade, proceeded on privilege leave for two months and five days on the 2nd January 1894.

19th January, 1894.—No. 55.—Consequent on the departure of Mr. C. P. Fisher, Officiating Deputy Conservator of Forests, 4th Grade, on privilege leave, the following promotion shall have effect from 8th January 1894 ;—

Mr. A. V. Monro, Assistant Conservator of Forests, 1st Grade, to officiate as Deputy Conservator of Forests, 4th Grade.

20th January, 1894.—No. 60.—On return from the three months' privilege leave granted to him in *Punjab Government Gazette* Notification No. 458, dated 28th August 1893, Mr. L. Gisborne-Smith, Deputy Conservator of Forests, resumed charge of the Hazára Forest Division, relieving Bhái Sádhu Singh, Extra Assistant Conservator of Forests, on the forenoon of the 2nd January 1894.

Bhái Sádhu Singh remains attached to the Hazára Forest Division.

20th January, 1894.—No. 64.—Mr. C. P. Fisher, Officiating Deputy Conservator of Forests, proceeded on the three months' privilege leave granted him in *Punjab Government Gazette* Notification No. 580, dated 16th November 1893, making over charge of the Kulu Forest Division to Mr. A. M. Reuther, Deputy Conservator of Forests, on the afternoon of 7th January 1894.

7—.CENTRAL PROVINCES GAZETTE.

4th January 1894.—No. 70.—The following officers appointed by Her Majesty's Secretary of State for India to the Indian Forest Service reported their arrival at Bombay on the 27th November 1893, and at Nagpur on the afternoon of the 30th idem :—

Mr. R. C. Milward, Assistant Conservator of Forests.

Mr. F. Linnell, Assistant Conservator of Forests.

Mr. C. O. Hanson, Assistant Conservator of Forests.

Mr. R. C. Milward is posted to the Northern Circle, and Messrs. F. Linnell and C O. Hanson are posted to the Southern Circle.

4th January 1894.—No. 78.—Privilege leave for two months and five days, under Article 291 of the Civil Service Regulations, is granted to Mr. H. S. K. Edie, Assistant Conservator of Forests, Chhindwara, with effect from the date on which he may be permitted to avail himself of it.

11th January 1894.—No. 218.—On return from the three months privilege leave granted him by Notification No. 3944, dated the 22nd August 1893, Mr. M. Muttannah, Extra-Assistant Conservator of Forests, is posted to the charge of the Nimar Forest Division.

11th January 1894.—No. 219.—Mr R. C. Milward, Assistant Conservator of Forests, is posted to the Betul Forest Division as Working-Plans Assistant.

11th January 1894.—No. 220.—On return from the three months' privilege leave granted him by Notification No. 4196, dated the 7th September 1893, Mr. A. M. F. Caccia, Assistant Conservator of Forests, is posted to the Hoshangabad Forest Division as Working-Plans Assistant.

11th January 1894.—No. 221 —With reference to Notification No. 220, dated the 11th instant, Mr. A. M. F. Caccia, Assistant Conservator of Forests, assumed charge of his duties on the forenoon of the 14th December 1893.

11th January 1894.—No. 222.—On return from the three months' privilege leave granted him by Notification No. 5123, dated the 2nd November 1893, Mr. S. G. Pranjpe, Extra-Assistant Conservator of Forests, is posted to the Mandla Forest Division as Working-Plans Assistant.

11*th January*—1894.—No. 223.—Mr. R. C. Thompson, Extra-Assistant Conservator of Forests, on being relieved of the charge of the Betul Forest Division by Mr. H. Moore, Deputy Conservator of Forests, is posted to the Saugor Forest Division as Working-Plans Assistant.

20*th January*—1894.—No. 425.—Mr. H. S. K. Edie, Assistant Conservator of Forests, transferred from the Chhindwara Forest Division to the Direction Division, made over charge of his duties at Chhindwara to the Conservator of Forests, Southern Circle, Central Provinces, on the afternoon of the 14th December 1893, and joined the Direction Division on the afternoon of the 14th December 1893.

20*th January*, 1894.—No. 426.—Mr. P. H. Clutterbuck, Officiating Deputy Conservator of Forests and Working-Plans Officer, is posted to the Chhindwara Forest Division. He received charge of his duties at Chhindwara from the Conservator of Forests, Southern Circle, Central Provinces, on the forenoon of the 27th December 1893.

20*th January*, 1894.—No. 427.—Mr. H. S K. Edie, Assistant Conservator of Forests, availed himself, on the forenoon of the 2nd January 1894, of the two months and five days' privilege leave granted him by Order No. 73, dated the 4th instant.

20*th January*, 1894.—No. 435.—Mr. F S. Barker, Deputy Conservator of Forests, has been granted, by Her Majesty's Secretary of State for India, six months leave on medical certificate in further extension of the medical leave granted him by Notification No. 3559, dated the 2nd August 1893.

20*th January*, 1894.—No. 444.—Mr. F. O Lemarchand, Deputy Conservator of Forests, 3rd Grade, Punjab, who has been transferred to the Central Provinces, is posted, on arrival, to the charge of the Balaghat Forest Division.

8.—Burma Gazette.

21*st December* 1893.—No. 38.—With reference to Revenue Department Notification No. 486 (Forests), dated the 8th December 1893, Mr. C. B. Smales, Assistant Conservator of Forests, reported his arrival at the headquarters of the Lower Chindwin division on the forenoon of the 18th December 1893.

21*st December*, 1893.—No. 12.—With reference to Revenue Department Notifications Nos. 409, 411 and 413 of the 21st October 1893, Mr. D. L. Richardson, Myoôk, reported his arrival at Shewbo on the afternoon of the 6th instant for forest settlement duty.

23*rd December*, 1893.—No. 9.—Mr. T. A. Hauxwell, Deputy Conservator of Forests, reported his return to duty from the privilege leave granted him in Revenue Department Notification No. 331 (Forests), dated the 25th August 1893, on the afternoon of the 22nd December 1893.

23*rd December*, 1893.—No. 10.—Mr. J. Messer, Assistant Conservator of Forests made over and Mr. T. A. Hauxwell, Deputy Conservator of Forests, received, charge of the Agency and Salween-Attaran divisions and the Tenasserim Forest Surveys on the afternoon of the 22nd December 1893.

28th December, 1893.—No. 507.—Mr. R. F Lowis, Extra Assistant Conservator of Forests, 4th Grade, on probation, is confirmed in his appointment with effect from the 2nd November, 1893.

28th December, 1893.—No. 13.—Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests, reported his return on the afternoon of the 2nd December 1893, from the privilege leave granted him in Revenue Department Notification No. 381 (Forests), of the 7th October, 1893.

28th January 1893 No. 14.—With reference to Revenue Department Notification No. 480 (Forests), of the 4th December, 1893, Mr. R. M. Kavanagh and Mr. C W. B. Anderson, Extra Assistant Conservators of Forests, respectively made over and received charge of the Mandalay Revenue subdivision on the afternoon of the 4th December, 1893.

28th December, 1893.—No. 15.—With reference to Revenue Department Notification No. 481 (Forests), dated the 4th December, 1893, Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, received charge of the Myadaung subdivision of the Katha division on the afternoon of the 12th December, 1893.

29th December, 1893.—No. 13.—With reference to Revenue Department Notification No. 484F., dated the 7th December, 1893, Mr. H. Carter, Assistant Conservator of Forests, reported his arrival from leave on the forenoon of the 12th December 1893.

29th December, 1893.—No. 14.—With reference to Revenue Department Notification No. 488F., dated the 11th December, 1893, Mr. H. Carter, Assistant Conservator of Forests, assumed charge of the Working Plans division on the afternoon of the 16th December, 1893.

2nd January, 1894.—No, 1.—With reference to Revenue Department Notification No. 488 (Forests), dated the 11th December, 1893 Mr. F. J. Branthwaite, officiating Deputy Conservator of Forests relinquished charge of the Working Plans division on the afternoon of the 7th December, 1893.

2nd January, 1894.—No. 2.—With reference to Revenue Department Notification No. 488 (Forests), dated the 11th December, 1893 Mr J. Messer, Assistant Conservator of Forests, assumed charge of his duties at Toungoo of the 29th December, 1893.

2nd January, 1894.— 1894.—No. I.—With reference to Revenue Department Notification No. 491 (Forests), dated the 13th December, 1893 Mr. E. S. Carr, Deputy Conservator of Forests, received charge of the Bhamo division, from Mr. C. R. Dun, Assistant Conservator of Forests, on the forenoon of the 25th December, 1893.

5th January, 1894.—No. 2.—With reference to Revenue Depatment Notification No.492 (Forests), dated the 13th December, 1893, Mr. C. R. Dun, Assistant Conservator of Forests, reported himself for duty in the Shwebo district on the forenoon of the 28th December, 1893.

10—HYDRABAD RESIDENCY GAZETTE.

9th January, 1894.—No. 6.—Mr. R. M. Williamson, appointed an Assistant Conservator of Forests, 2nd grade, by Her Majesty's Secretary of State for India, arrived at Amraoti on the forenoon of the 29th November, 1893, and has been posted to the Ellichpur Forest Division.

1[illegible].—MYSORE GAZETTE.

26th December, 1893,—No. 10662—G. 2277.—Mr. B. Hira Singh, Forest Probationer, is appointed Sub-Assistant Conservator of Forests *sub pro tem* with effect from the date on which he relieved Mr. B. Ramaswami Iyer of the charge of the Forest Department, Kadur District.

24th December 1893, No. 11616—G. F. 291-92.—Mr. B. Ramaswami Iyer, Sub-Assistant Conservator of Forests, was on sick leave from 11th September, to 12th November, 1893. This cancels Notification No. 6424—G. F. 291-92 dated 29th September, 1893.

X—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

26th January, 1894.—No. 142 F.—The following transfers are ordered in the interest of the public service:—

Mr. F. O. Lemarchand, Deputy Conservator of Forests, 2nd grade, Punjab—to the Central Provinces.

Mr. F. S. Barker, Deputy Conservator, 4th grade, Central Provinces (on furlough)—to the Punjab.

2.—Madras Gazette.

26th January, 1894.—No. 36.—Mr. S. C. Moss, Acting District Forest Officer, Madura, privilege leave for three months, from 15th February 1894, under article 291 of the Civil Service Regulations.

30th January, 1894.—The following subordinates have passed the Departmental Test held in January, 1894 :—

No.	Names.	Designation.	Subject in which passed.
1	R. Srinivasa Raghavachari	Forester, Chingleput ...	Code & Accounts.
2	T. B. Rajagopaul Mudaliar ...	Temporary Forester, North Arcot ...	Do.
3	K. Kailasa Aiyar ...	Clerk, District Forest Office, North Arcot ...	Do.
4	Vasudeva Reddy ...	Temporary Forester, North Arcot ...	Do.
5	C. Srinivasalu Naidu ...	Range Clerk, North Arcot	Do.
6	C. Narayanaswami Mudaliar ...	Temporary Forester, do.	Forest Law.
7	V. M. Varadarajulu Naidu	Clerk, North Arcot ...	Code & Accounts.
8	M. Ponnaranga Mudaliar	Forester, Nellore ...	Do.
9	L. Govindaswami Pillai	Forest Range Clerk, South Arcot ...	Do.
10	D. Srinivasa Chari ...	Range Clerk, South Arcot	Do.
11	D. J. Evers ...	Temporary Forester, Salem	Do.
12	M. Subramania Aiyar ...	Acting Forester, Trichinopoly ...	Do.

16th February, 1894.—No. 67.—The notification granting three months' privilege leave to Mr. S. C. Moss, Extra Assistant Conservator of Forests, published at page 113 of Part I of the *Fort St. George Gazette*, dated 30th January, 1894, is hereby cancelled.

11*th February*, 1894 — Mr. S. C. Moss, Extra Assistant Conservator of Forests, 2nd Grade, is transferred from Tinnevelly to South Canara.

12*th February*, 1894.—V. Mukyaprana Row, Forester, 4th Grade, Vizagapatam District, passed the Departmental Examination in Forest Law, Code and Accounts held in January 1894.

16*th February*, 1894.—The leave of absence to Ranger Jambunada Sastri, notified at page 83, Part II, of the *Fort St George Gazette* of, 23rd January, 1894, is extended by another month, *i e*, up to 27th February, 1893.

3.—BOMBAY GAZETTE.

26*th January*, 1894 —Mr. B. H. Dalal, L.C.E., Sub-Division Forest Office, West Khandesh, delivered over charge of his office, and duties to Mr. H. W. Keys, Divisional Forest Officer of West Khandesh, on the 10th January 1894, after office hours, and proceeded on one month's privilege leave granted to him by the undersigned.

27*th January*, 1894 —No. 721.—Mr. G. M Hodgson, Assistant Conservator of Forests, First Grade, and Working Plans Divisional Forest Officer, Kanara, is allowed privilege leave of absence for three months from 14th February, 1894, or such subsequent date as he may avail himself thereof.

30*th January*, 1894.—No. 763.—Mr. J H. Clabby, Extra Assistant Conservator of Forests, Third Grade, passed an examination in Surveying according to the test prescribed in Rule of 6 of the old rules published in Government Notification No. 2,878, dated 4th June, 1880, for the examination of Forest Officers.

Mr. Chunilal Gulabchand Dalia, L C.E, acting Extra Assistant Conservator of Forests, Fourth Grade, and Sub-Division Officer, Surat, has been allowed one month's privilege leave from the 17th January, 1894.

Mr. C. G. Dalia, acting Extra Assistant Conservator of Forests, Fourth Grade, and Mr. W. A. Wallinger, Divisional Forest Officer, Surat, respectively delivered over and received charge of the Sub-Division Office, Surat, on the 17th January, 1894, before noon.

2*nd February*, 1894.—No 843.—His Excellency the Governor in Council is pleased to appoint Mr. Haripal Mitra, L.C.E, Extra Assistant Conservator of Forests, Second Grade, to hold charge of the office of Working Plans Divisional Forest Officer, S.C., during the absence of Mr. C M. Hodgson on privilege leave or pending further orders.

13*th February*, 1894.—Mr. W. F. D. Fisher, Assistant Conservator of Forests, Second Grade, and Divisional Forest Officer, Panch Mahals, has been granted one month's privilege leave from the 13th February, 1894.

15*th February*, 1894.—No. 1,245.—His Excellency the Governor in Council is pleased, with effect from the date of this order :—

to suspend the lien of Mr. J. M. Fernandez, First Grade Extra Assistant Conservator of Forests, on his British appointment to promote Mr. R. H. Mádan, L C E., to be First Grade Extra Assistant Conservator of Forests, *vice* Mr. Fernandes ;

to appoint Mr. B. H. Dalál, L.C.E., to be substantive *pro tem.* Second Grade Extra Assistant Conservator of Forests *vice* Mr. Madan.

19th February, 1894.—Mr. L. D. Joshi, Extra Assistant Conservator of Forests, having delivered over charge of the Sub-Division Office Poona, to Mr. Clabby on the 6th January last, reported himself for duty to the Divisional Forest Officer of Nasik on the 13th idem, before office hours.

5—N. P. W. AND OUDH GAZETTE.

No. 286.—Mr. Raghunath Pathak, Extra Assistant Conservator of Forests, attached to the Direction Division of the Central Circle, privilege leave for one month, with effect from the 20th February, 1894.

12th February, 1894.—No. 386.—Mr. E. McA. Moir, Deputy Conservator of Forests, in charge of the Jaunsar Forest Division of the School Circle, furlough out of India for eight months, with effect from the 10th March, 1894.

12th February, No. 390.—Mr. B. B. Osmaston, Assistant Conservator of Forests, in charge of the Philibit Forest Division of the Oudh Circle, on being relieved by Mr J. M. Blanchfield, to the charge of the Jaunsar Forest Division of the School Circle.

12th February, 1894—No. 394 Mr. J. M. Blanchfield, Extra Assistant Conservator of Forests, attached to the Gorakhpur Forest Division of the Oudh Circle, to the charge of the Pilibhit Forest Division of the same Circle, until further orders.

15th February, 1894.—No. 449.—Mr Keshavanand, Extra Assistant Conservator of Forests, attached to the Direction Division of the Oudh Circle, is appointed Working Plans Officer, with effect from the 1st November, 1893.

6—PUNJAB GAZETTE.

25th February, 1894 —No. 79.—Mr E. M. Coventry, Assistant Conservator of Forests, transferred from Berar to the Punjab, reported his arrival in Lahore on the forenoon of the 5th December, 1893, and was attached to the Working Plans Division with effect from that date.

2nd February, 1894.—No. 96.—With reference to the Notification of the Government of India, Revenue and Agricultural Department, No. I F., dated the 2nd January, 1894, the following officers are appointed Assistant Conservators of the 2nd Grade on the amalgamated list of Forest Officers for the Punjab, Central Provinces, Berar and Coorg with effect from the dates entered against their names:—

Mr. R. M. Williamson	...	**16th November 1893.**
Mr. R. C. Milward	...	**27th November 1893.**
Mr. F. Linnell	...	**27th November 1893,**
Mr. C. O. Hanson	...	**27th November 1993.**

3rd February, 1894.—No. 103.—Mr. E. M. Coventry, Assistant Conservator of Forests, Punjab, passed the prescribed Departmental Examination in Hindústáni by the Higher Standard on the 23rd January, 1894.

6th February, 1894.—No. 116.—Under the provisions of Section 2 of the Indian Forest Act, VII of 1878 and in supersession of *Punjab Government Gazette* Notification No. 489, dated 22nd September, 1893, the Hon'ble the Lieutenant-Governor is pleased to appoint the Chief Commissariat Officer, Sirhind District, Umballa, to be a Forest Officer in respect of Bír Chappar (or Dhantauri) and Bír Sujra, which have been declared to be Reserved Forests by Notification No. 435, dated 14th August, 1893.

15th February 1894.—No. 134.—Consequent on the transfer of Mr. F. O Lemarchaud, Deputy Conservator of Forests, to the Central Provinces (*vide* Government of India Notification No. 142 F. of 26th January 1894), Mr. C. Somers Smith, Officiating Deputy Conservator of Forests, assumed charge of the Kángra Forest Division on the afternoon of the 6th February, 1894.

20th February, 1894.—No. 150.—Mr J. Ballantine, Deputy Conservator of Forests, 2nd Grade, on deputation, proceeded on two years furlough with effect from the 16th June, 1893.

Mr Ballantine's deputation to His Highness the Nizám's Dominions ceased on 16th June, 1893.

Consequent on the above, the following reversions will have effect from 16th June, 1893 :—

Mr. L. G. Smith, Provisional Deputy Conservator of Forests 3rd Grade, and Officiating Deputy Conservator of Forests, 2nd Grade, to Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 2nd Grade.

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade, to Assistant Conservator of Forestst 1st Grade.

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade, to Assistant Conservator of Forests, 2nd Grade, and Officiating Deputy Conservator of Forests, 4th Grade.

Punjab Government Notification No. 639, dated 9th December, 1893, is hereby cancelled.

No. 15.—The following statement showing the names and position of officers on the amalgamated list on the 21st July, 1893 should be subsituted for that published with Punjab Government Notification No. 670, dated 13th December, 1893 :—

Sanctioned scale.	Names.	Position
Deputy Conservator of Forest 1st Grade (4)	1. J. C. McDonell ..	On deputation.
	2. F. B. Dickinson	On furlough.
	3. C. F. Elliott ..	Deputy Conservator of Forests, 1st Grade.
	4. J. McKee ...	Officiating Conservator of Forests.
Deputy Conservators of Forest, 2nd Grade (5)	5. G. G. Minniken ..	Provisional Deputy Conservator of Forests, 1st Grade.
	6. W. P. Thomas ...	Officiating Deputy Conservator of Forests, 1st Grade.
	7. E. Forrest ...	Ditto.
	8. L. A. W. Rind ...	Deputy Conservator of Forests, 2nd Grade.
	9. F. O. Lemarchand	Ditto.
Deputy Conservators of Forests, 3rd Grade (5)	10. G. F. Prevost ...	Provisional Deputy Conservater of Forests, 1st Grade.
	11. J. Ballantine ...	On furlough.
	12. E. Dobbs ...	On sick leave.
	13. W. King ...	Officiating Deputy Conservator of Forests, 2nd Grade.
	14. A. M. Reuther ...	On furlough.
Deputy Conservators of Forests, 4th Grade (8)	15. J. H. Lace ...	Ditto.
	16 L. G. Smith ...	Officiating Deputy Conservator of Forests, 2nd Grade.
	17. F. S. Barker ...	On sick leave.
	18, H. Moore ...	On furlough.
	19. G. F. Taylor ...	Officiating Deputy Conservator of Forests, 3rd Grade.
	20. A. L. McIntire...	Ditto
	21. H. A. Hoghton ...	Ditto
	22. H. Calthrop ...	Ditto
Assistant Conservators of Forests 1st Grade (8)	23. F. C. Hicks ...	Provisional Deputy Conservator of Forests, 4th Grade and Officiating Deputy Conservator of Forests 3rd Grade.
	24. R. J. P. Pinder ...	Officiating Deputy Conservator of Forests, 4th Grade.
	25. A. E. Lowrie ...	Ditto.
	26. C. S. Smith ...	Ditto.
	27. G. S. Hart ...	Ditto.
	28 C. P. Fisher ...	Ditto.
	26. A. V. Monro ...	Ditto.
	30 A. W. Blunt ...	Ditto.
	31. P. H. Clutterbuck	Provisional Asst. Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th
Assistant Conservators of Forests 2nd Grade (7)	32. A. M. F. Caccia ...	Officiating Asst. Conservator of Forests, 1st Grade.
	33. E. M. Coventry...	On examination leave.
	34. H. S. K. Edie ..	Officiating Asst. Conservator of Forests, 1ts Grade.
	35—37 Vacant.	

No. 152.—In Punjab Government Notification No. 641, dated 9th December, 1893, *for* "Mr. A. M. F. Caccia Provisional Assistant Conservator of Forests, 1st Grade," *read* "Mr. A. M. F. Caccia, Officiating Assistant Conservator of Forests, 1st Grade."

No. 153.—In Punjab Government Notification No. 671, dated 16th December, 1893, *for* "Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade," *read* "Mr. R J. P. Pinder, Officiating Deputy Conservator of Forests, 4th Grade."

No 354.—Consequent on the return from furlough of Mr. H. Moore, Deputy Conservator of Forests, 4th Grade, the following changes will have effect from 22nd August, 1893 :—

Mr. H Moore, Deputy Conservator of Forests, 4th Grade, to Officiating Deputy Conservator of Forests, 3rd Grade;

Mr. R. J P. Pinder, Officiating Deputy Conservator of Forests, 3rd Grade, to Officiating Deputy Conservator of Forests, 4th Grade;

Mr. H. S. K. Edie, Officiating Deputy Conservator of Forests, 4th Grade, to Officiating Assistant Conservator of Forests, 1st Grade.

Punjab Government Notification No. 672, dated 16th December, 1893, is hereby cancelled.

No. 155.—In Punjab Government Notification No. 673, dated 16th December 1893, *for* "Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th Grade," *read* "Mr. R. J. P. Pinder, Officiating Deputy Conservator of Forests, 4th Grade."

No. 156.—In Punjab Government Notification No. 642, dated 9th December, 1893, *for* "Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests. 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade," *read* "Mr. A. M. F. Caccia, Assistant Conservator of Forests, 2nd Grade, and Officiating Deputy Conservator of Forests, 4th Grade"

No. 157.—In Punjab Government Notification No. 643, dated 9th December, 1893. *for* "Mr. L. G. Smith, Provisional Deputy Conservator of Forests, 3rd Grade, and Officiating Deputy Conservator of Forests, 2nd Grade, *read* "Mr. L. G. Smith, Deputy Conservator of Forests, 4th grade and Officiating Deputy Conservator of Forests, 2nd Grade.

No. 158.—Consequent on the return from sick leave of Mr. Dobbs. Deputy Conservator of Forests, 3rd Grade, the following charges will have effect from 25th October 1893:—

Mr. Dobbs, Deputy Conservator of Forests, 3rd Grade, to Officiating Deputy Conservator of Forests, 2nd Grade;

Mr. G. F. Taylor, Officiating Deputy Conservator of Forests, 2nd Grade, to Officiating Deputy Conservator of Forests, 3rd Grade.

Mr. R. J. P. Pinder, Officiating Deputy Conservator of Forests, 3rd Grade, to Officiating Deputy Conservator of Forests 4th Grade.

Punjab Government Notification No. 645, dated 9th December, 1893, is hereby cancelled.

No. 159.—In Punjab Government Notification No. 647, dated 9th December 1893, *for* "Mr. J. P, Pinder, Provisional Deputy Conservator of Forests, 4th Grade," *read* "Mr. R. J. P. Pinder, Officiating Deputy Conservator of Forests, 4th Grade."

No. 160.—Consequent on the return from privilege leave of Mr. H. A. Hoghton, Officiating Deputy Conservator of Forests, 3rd Grade, the following reversions will have effect from 27th November 1893 :—

Mr. R. J. P. Pinder, Officiating Deputy Conservator of Forests, 3rd Grade, to Officiating Deputy Conservator of Forests, 4th Grade ;

Mr. A. M. F. Caccia, Officiating Deputy Conservator of Forests, 4th Grade, to Officiating Assistant Conservator of Forests, 1st Grade ;

Mr. H. S K. Edie, Officiating Deputy Conservator of Forests, 4th Grade, to Officiating Assistant Conservator of Forests, 1st Grade ;

Punjab Government Notification No. 643, dated 9th December 1893, and No. 17, dated 6th January 1894, are hereby cancelled.

No. 161.—Consequent on the return from privilege leave of Mr. F. O. Lemarchand, Deputy Conservator of Forests, 2nd Grade, the following reversions will have effect from 8th December 1893 :—

Mr. L. G Smith, Officiating Deputy Conservator of Forests, 2nd Grade, to Officiating Deputy Conservator of Forests, 3rd Grade ;

Mr. H. Moore, Officiating Deputy Conservator of Forests, 2nd Grade to Officiating Deputy Conservator of Forests, 3rd Grade;

Mr. F. C. Hicks, Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade, to Provisional Deputy Deputy Conservator of Forests, 4th Grade ;

Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade, to Provisional Assistant Conservator of Forests, 1st Grade

Punjab Government Notification No. 18, dated 6th January 1894, is hereby cancelled.

No. 162.—In Punjab Government Notification No. 19, dated 6th January 1894, *for* "Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st Grade," *read* Mr. A. M. F. Caccia, Officiating Assistant Conservator of Forests, 1st Grade."

No. 163.—In Punjab Government Notification No. 53, dated 19th January 1894, *for* "Mr. L. Gisborne Smith, Provisional Deputy Conservator of Forests, 3rd Grade,," *read* "Mr. L. Gisborne Smith, Officiating Deputy Conservator of Forests, 3rd Grade.

7.—CENTRAL PROVINCES GAZETTE.

20th January, 1894.—No. 537.—Mr. M. Muttannah, Extra-Assistant Conservator of Forests, returned from the three months' privilege leave granted him by Notification No. 3944, dated the 22nd August 1893, and, with reference to Order No. 218, dated the 11th January 1894, assumed charge of the Nimar Forest Division from Mr. Mohammad Kadir Bakhsh, Extra-Assistant Conservator of Forests, on the afternoon of the 30th December 1893.

8th February, 1894.—No. 636.—Privilege leave for two months and twenty-nine days, under Article 291 of the Civil Service Regulation*, is granted to Mr. L. A. W. Rind, Deputy Conservator of Forests, Narsinghpur, with effect from the 2nd March 1894, or from such subsequent date as he may be permitted to avail himself of it.

6th February 1894.—No. 1.—With the previous approval and sanction of the Chief Commissioner, Central Provinces, the following Forest Rangers are posted as Working-Plans Assistants to the Forest Division entered against their names:—

Mr. A. T. C. Howell	...	Nimar.
„ Faiz Baksh	...	Damoh.
„ S. R. Parsons	...	Jubbulpore.
„ Amrit Lall Chatterji	...	Narsinghpur.

15th February 1894.—No. 813.—*Corrigendum*.—In Notification No. 444, dated the 20th January 1894, *for* "Mr. F. O. Lemarchand, Deputy Conservator of Forests, 3rd grade, Punjab," *read* "Mr. F. O. Lemarchand, Deputy Conservator of Forests, 2nd grade, Punjab."

8.—BURMA GAZETTE.

19th January 1894.—No. 1.—With reference to this office Notification No. 35, dated the 12th December 1893, Mr. H. H. Forteath, Assistant Conservator of Forests, assumed charge of the Paungbyin subdivision, Upper Chindwin division, from Mr. C. W. A. Bruce, Assistant Conservator of Forests, on the forenoon of the 12th December 1893.

20th January, 1894.—No. 20.—The following transfers are ordered in the Forest Department:—

Mr. F. W. Thellusson, Deputy Conservator of Forests, from Minbu to the charge of the Thayetmyo forest division.

No. 16.—The Chief Commissioner directs that, with effect from the 1st February 1894, the Rangoon Forest division shall be divided into two divisions, to be called respectively the Pegu Forest Division, with headquarters at Pegu, and the Rangoon Forest division, with headquarters at Rangoon.

The local limits of the Pegu Forest division shall be those of the Pegu district, and the Upper Zamayi reserve. The local limits of the Rangoon Forest division shall be those of the Hanthawaddy district.

No. 17.—Mr. W. F. L. Tottenham, officiating Deputy Conservator of Forests, is posted to the charge of the Pegu Forest division.

24th January 1894.—No. 18.—The following temporary alterations of rank are ordered in the Forest department:—

(1) With effect from the 17th December 1893, in consequence of the return from leave of Mr. H. Carter, Assistant Conservator of Forests:

Mr. H. Carter, Assistant Conservator, 1st, to officiate as Deputy Conservator, 4th grade.

Mr. W. T. T. McHarg, Assistant Conservator, 1st, officiating Deputy Conservator, 4th grade, to revert to his substansive appointment.

Mr. R. C. Dun, Assistant Conservator, 2nd, officiating 1st grade, to revert his substantive appointment.

(2) With effect from the 23rd December 1893, in consequence of the return from leave of Mr. Hauxwell, Deputy Conservator of Forests

Mr. J. C. Murray, Deputy Conservator, 3rd, officiating 2nd grade, to revert to his substantive appointment.

Mr. A. F. Gradon, Deputy Conservator, 4th, officiating 3rd grade, *seconded*, to revert to his substantive appointment.

Mr. G. Q. Corbett, Deputy Conservator, 4th, officiating 3rd grade, to revert to his substausive appointment.

Mr. W. F. L. Tottenham, Assistant Conservator, 1st, officiating Deputy Conservator,, 4th grade, to revert to his substantive appointment.

Mr. A. M. Burn-Murdoch, Assistant Conservator, 2nd officiating 1st grade, to revert to his substantive appointment.

(3) With effect from the 25th December 1893 in consequence of the return from leave of Mr. Carr, Deputy Conservator of Forests :—

Mr. E. S. Carr, Deputy Conservator. 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. A Weston, Deputy Conservator, 3rd, officiating 2nd grade, to revert to his substantive appointment.

Mr. C. E. Muriel, Deputy Conservator, 4th, officiating 3rd grade, to revert to his substantive appointment

Mr. E A. O'Bryen, Assistant Conservator, 1st, officiating Deputy Conservator, 4th grade, to revert to his substantive appointment.

Mr. G. R. Long, Assistant Conservator, 2nd, officiating 1st grade, to revert to his substantive appointment.

3rd February 1894 —No. 39 —Mr. G. R. Long, Assistant Conservator of Forests, on special duty in the Kado division, is re-transferred to the charge of the Agency division, *vice* Mr. T. A Hauxwell, Deputy Conservator of Forests, and is placed in charge of the AttaranYe subdivision of the Salween-Attaran division, in addition to his other duties.

6th January 1894.—No. 47.—On return from leave Mr. H. N. Thompson, Assistant Conservator of Forests, is posted to the charge of the Mingin subdivision, Lower Chindwin forest division.

No 48.—Mr W. T. T. McHarg, Assistant Conservator of Forests, on being relieved by Mr Thompson, Assistant Conservator of Forests, is posted to special duty in the Yaw forest division.

9th February 1894 —No. 56.—Mr. G. F. R. Blackwell, Assistant Conservator of Forests, is transferred from Shwegyin to the charge of the South Tenasserim division of the Tenasserim forest circle.

No. 57.—Mr. C. Ingram, Extra Assistant Conservator of Forests, is transferred from Tavoy to the charge of the Shwegyin division of the Pegu forest circle.

No. 58 —In exercise of the powers conferred by section 34, subsection (2) of the Upper Burma Forest Regulation, 1887, the chief Commissioner directs that conditions (2) and (5) of the conditions specified in Appendix II to the Rules under the Regulation published in Revenue Department Notification No. 140, dated the 19th April 1893, shall be modified as follows :—

To condition (2) the following words shall be added :

"At the time the timber is so marked this license shall be returned to the Forest official who marks the said timber."

For condition (5) the following shall be substituted :

"(5) That unless a commencement has been made in the utilization for the purpose specified of the timber for which this license is granted before the

18 (*i e.*, before the expiry of the period for which this license is issued), all timber that may have been felled or removed under this license shall lapse to Government.

17th February 1894.—No 72.—Mr. J. Messer, Assistant Conservator of Forests, is posted as a temporary measure to the charge of the Shwegyin Forest division.

19th February 1894. —No. 2 —Mr. T. H. Aplin, Deputy Conservator of Forests, Lower Chindwin, division, made over, and Mr. C. B Smales, Assistant Conservator of Forests, assumed charge as a temprary arrangement of the Mingin subdivision on the afternoon of the 3rd February 1894

9.—ASSAM GAZETTE.

6th February, 1894.—No. 1137G.—Mr. H. S. K. Edie, Assistant Conservator of Forests, Second Grade, who was transferred to Assam by Revenue and Agricultural Department Notification No. 44F., dated the 10th January 1894, is placed in charge of the Nowgong Forest Division.

20th February, 1894.—No- 1143G.—In supersession of Notification Fo- 1143G, dated the 6th February 1894, published at page 108 of the *Assam Gazette* of the 4th idem, Mr. H. S. K. Edie, Assistant Conservator of Forests, Second Grade, who was transferred to Assam by Revenue and Agricultural Department Notification No. 45F., dated the 10th January 1894, is attached to the Kamrup Forest Division.

20th February, 1894,—No. 1644G.—Furlough for one year, under article 371 of the Civil Service Regulations, is granted to Mr. H. G. Young, Deputy Conservator of Forests, in charge of the Kamrup Forest Division, with effect from the 1st April 1894, or the subsequent date on which he may avail himself of it.

20th February, 1894 —No. 164'G.—Mr. H. S. K. Edie, Assistant Conservator, attached to the Kamrup Forest Division, is placed in charge of that Division during the absence on furlough of Mr. H. G. Young, or until further orders.

10—. HYDERABAD RESIDENCY GAZETTE.

24th January, 1894 —No. 25.—Mr. E. M. Coventry, late an Assistant Conservator of Forests in Berar, was attached to the Direction Division as Working-Plans Assistant from the afternoon of the 11th to the forenoon of the 29th November 1893.

11 —Mysore Gazette.

7th February, 1894—No. 13005—G., 2826.—The following transfers of Forest Officers are ordered :—

(1) Mr. C. E. M. Russell, Superintendent of Forests, Bangalore District, to be Superintendent of Forests, Kadur District : to join on being relieved.

(2) Mr. T. Abdul Karim, Head-quarter Assistant to the Inspector General of Forests, to be District Forest Officer, Mysore District, *vice* Mr. G. Sitaramaiya transferred.

(3) Mr. G. Sitaramaiya, Assistant Conservator of Forest, Mysore, District, to be District Forest Officer, Bangalore District, *vice* Mr. C. E. M. Russell : to join on being relieved.

(4) Mr. B Ramaswami Iyer, on Special duty in the Mysore District, to be District Forest Officer, Kolar District, *vice* Mr. B. Srinivasa Rao transferred : to join forthwith.

(5) Mr. R. Srinivasa Rao, Sub-Assistant Conservator of Forests, Kolar District, to be Sub-Division Forest Officer, Shikarpur Forest Sub-Division, *vice* Mr. M. G. Rama Rao : to join on being relieved.

(6) Mr. B Heera Singh, Sub-Assistant Conservator of Forest *Sub pro tem*, Kadur District, to be Sub-Division Forest Officer, Hunsur Forest Sub-Division, *vice* Mr. K. Shamaiengar : to join on being relieved.

(7) Mr. M G Rama Rao, Forest Probationer, Shikarpur, to be Sub-Division Forest Officer, Heggaddevankote : to join on being relieved.

12*th March* 1894.—No. 119.—

No.	Name and designation of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. F. Foulkes, Acting District Forest Officer, South Canara.	Assistant Conservator of Forests, 2nd Grade.	Assistant Conservator of Forests, 2nd Grade.	Permanent.	With effect from 18th January, 1894.

POSTING.

12*th March*, 1894.—No, 120.—

No.	Name of Officer.	District.	Nature of charge.	Remarks.
1	Mr. F. Foulkes, Assistant Conservator of Forests, 1st Grade.	South Canara.	District Forest Officer.	Confirmation of Acting District Forest Officer.

13*th March*, 1894 —N. S. Veeracharlu, Forest Ranger, on special duty, Bellary, is transferred to Ganjam District on public service.

16*th March*, 1894.—The six months' leave on medical certificate granted in Service Order No. 208 of 1893 to Mr. C. P. Howeli, Sub-Assistant Conservator of Forests, Madura is extended by one month.

3.—Bombay Gazette.

19*th February*, 1894.—Mr. W. F. D. Fisher, Assistant Conservator of Forests, Second Grade, delivered over and Mr. F. R. Dasai, Deputy Conservator of Forests, N. C., received charge of the Divisional Forest Office, Panch Mahals, on the 12th February, 1894, in the afternoon.

2*nd March* —No. 1638.—Mr. W. R. Woodrow, Deputy Conservator of Forests Third Grade, and Divisional Forest Officer, Dhárwar, is allowed furlough one year and seven months from 1st May, 1894, or such subsequent date as he may avail himself of it.

7*th March*, 1894 —No. 1,702,—Mr. R. C. Wroughton, Deputy Conservator of Forests, First Grade, has been allowed by Her Najesty's Secretary of State for India to return to duty within the period of his leave.

12*th March*, 1894 —Mr. A. N. Master, Extra Assistant Conservator of Forests, Fourth Grade, delivered over and Mr. C. Greathead, Divisional Forest Officer, East Thana, received charge of, the Sháhápur Sub-Division Office on the 26th February, 1894, in the afternoon.

Mr. F. R. Dasai, Deputy Conservator of Forests, N. C., delivered over and Mr. A. N. Master, L. C. E., Extra Assistant Conservator of Forests, Fourth Grade, received charge of, the Divisional Forest Office, Panch Mahals, on the 1st of March, 1894, before noon.

14th March, 1894.—Mr. C. M. Hodgson, acting Deputy Conservator, delivered over and Mr. H. Mitra, Extra Assistant Conservator, received charge of the Divisional Forest Office, Working Plans Party No. 1, Southern Circle, on the afternoon of the 8th March, 1894.

19th March, 1894.—Mr. G. P. Millett, Deputy Conservator of Forests and Divisional Forest Officer, West Thana, has been granted one month's privilege leave from th 10th April, 1894.

23rd March, 1894.—Mr. Sheshu Manju, Extra Assistant Conservator of Forests and Sub-Divisional Officer, Haliyál, who was in this Office, No. 6,119, dated 2nd February, 1894, transferred to the Supa Range delivered over charge of the Haliyál range on the 4th instant after office hours, and received that of the Supa Range on the 7th idem, after office hours.

26th March, 1894—No. 2174.—His Excellency the Governor in Council is pleased to appoint Mr. Vishnu Mahádev Tilak to act as Extra Assistant Conservator of Forests, Fourth Grade, during the absence of Mr. J. H. Clabby, or pending further orders.

28th March, 1894.—No. 2,220.—Mr. W. F. D. Fisher, Assistant Conservator of Forests, Second Grade, and Divisional Forest Officer Panch Maháls, is granted an extension, by one month, of the privilege leave of absence for one month allowed to him in Notification, dated 13th February last, published at page 174 of the *Bombay Government Gazette* of the 22nd idem, Part 1, by the Deputy Conservator of Forests, N. C.

4.—BENGAL GAZETTE.

5th March, 1894.—The following officers held temporary charge of the Chittagong Forest Division for the periods named in each case (below):—

Babu Jago Mohun Bhattacharjee, Personal Assistant to the Commissioner of the Chittagong Division, from the afternoon of the 24th September, 1893 to the afternoon of the 27th September, 1893.

Mr. J. A. Cave-Browne, Assistant District Superintendent of Police, Chittagong Hill Tracts, from the afternoon of the 27th September, 1893 to the forenoon of the 8th November, 1893.

Mr. C. S. Murray, C.I.E., Assistant Commissioner, Chittagong Hill Tracts, from the forenoon of the 8th November, 1893, to the afternoon of the 19th idem.

27th March 1893—No.—1685For. Mr. E. E. Slane, Extra-Assistant Conservator of Forest, Sundarban Division, is granted 2 months and 22 days' privilege leave, under article 291 of the Civil Services Regulations, with effect from the 28th March, 1894, or any subsequent date on which he may avail himself of it.

5—N. W. P. AND OUDH GAZETTE.

30*th March*, 1894 —No. 1054.—The following temporary promotions and reversions among Forest Officers are notified for general information :—

Entry No.	With effect from—	Consequent on—	Name.	From—	To—
1	29th Jan. 1894.	Mr. A G. Hobart-Hampden, on privilege leave.	Mr A. P. Grenfell ...	Asst. Convr. 1st grade.	Offg. Deputy Convr. 4th gd.
2	1st Feb. 1894.	Mr. N. Hearle, on furlough.	Mr. E. A. Down ...	Depy. Convr. 3rd grade.	Offg Deputy Convr. 2nd gd
			Mr. A. G. Hobart-Hampden, on privilege leave. Mr. B. A. Rebsch ...	Dy. Convr. 4th grade.	Offg. Deputy Convr. 3rd gd.
			Mr. B. B. Osmaston .	Asst. Convr. 1st grade.	Offg. Deputy Convr. 4th gd.
			Mr. F. A. Leete ..	Asst. Convr. 2nd grade	Offg. Deputy Convr. 1st gd.
3	28th Feb. 1894.	Mr. A. G. Hobart-Hampden's return from privilege leave.	Mr. B. A. Rebsch ...	Offg. Deputy Convr. 3rd gd.	Depy. Convr. 4th grade.
			Mr. A. P. Grenfell ...	Offg. Deputy Convr. 4th gd.	Asst. Convr. 1st grade.
4	11th Mar. 1894.	Mr. E. Mc A. Moir, on furlough.	M. W. Shakespear ...	Depy. Convr. 2nd grade.	Offg. Deputy Convr 1st gd.
			M. F. B. Bryant ...	Depy. Convr. 3rd grade.	Offg. Deputy Convr 2nd gd.
			Mr. B. A. Rebsch	Depy. Convr. 4th grade.	Offg. Deputy Convr. 3rd gd.
			Mr. A. P. Grenfell .	Asst. Convr. 1st grade.	Offg. Deputy Convr 4th gd.

6.—PUNJAB GAZETTE.

26th *February* 1894.—No. 170.—A. L. No. 73.—*Promotion.*—With reference to Punjab Government Notification No. 103 dated 3rd February, 1894. His Honor the Lieutenant-Governor is pleased to make the following promotion to fill an existing vacancy :—

Mr. F. M. Coventry, Assistant Conservator of Forests 2nd Grade, to officiate as Assistant Conservator of Forests, 1st Grade, with effect from the 22rd January, 1894.

7.—CENTRAL PROVINCES GAZETTE.

6th *March* 1894.—No. 1,132.—Leave on urgent private affairs for six months, under Article 348 of the Civil Service Regulations, is granted to Mr. P. H. Clutterbuck, Officiating Deputy Conservator of Forests and Working-Plans Officer, with effect from the date on which he may be relieved of the charge of the Chhindwara Forest Division.

6th *March* 1894.—No. 1,133.— Mr. W. G. Gilmore, Forest Ranger, in charge of the Arvi-Ashti Range, Nagpur-Wardha Forest Division, is posted temporarily to the charge of the Chhindwara Forest Division, to work under the immediate orders of the Commissioner.

6th *March* 1894.—1,159.—Mr. Apa Saheb Mohite, Assistant Settlement Officer, returned from the three weeks' privilege leave granted him by Notification No 6,077; dated the 29th December 1893, and assumed charge of his duties at Jubbulpore on the forenoon of the 29th January 1894.

8th *March* 1894.—No. 1,226 —Furlough for one year, under Article 340 (*b*) of the Civil Service Regulations, is granted to Mr. W. P. Thomas, Officiating Deputy Conservator of Forests, 1st grade, in charge of the Hoshangabad Forest Division, with effect from the 1st instant, or the subsequent date on which he may avail himself of it.

8th *March* 1894.—No. 1,227.—Mr. A. M. F. Caccia, Assistant Conservator of Forests, is posted to the charge of the Hoshangabad Forest Division, during the absence on furlough of Mr. Thomas, Deputy Conservator of Forests, or until further orders.

8th *March* 1894.—No. 1,244.—Mr. Shridhar Ganesh Pranjpe, Extra-Assistant Conservator of Forests, returned from the three months' privilege leave granted him by Notification No. 5,123, dated the 2nd November 1893, and, with reference to Order No. 222, dated the 11th January 1894, assumed charge of his duties as Working-Plans Assistant, Mandla Division, on the forenoon of the 1st February 1894.

13th *March* 1894.—No. 1,290.—With reference to Order No. 445, dated the 20th January 1894, Mr. Ramchandra Krishna, Extra-Assistant Conservator, and Mr. F. O. Lemarchand, Deputy Conservator of Forests, respectively surrendered and received charge of, the Balaghat Forest Division on the forenoon of the 15th February 1894.

21st *March* 1894.—No. 1,490.—Mr. P. H. Clutterbuck, Officiating Deputy Conservator of Forests and Working-Plans Officer, availed himself, on the afternoon of the 5th instant, of the six months' leave on urgent private affairs granted him by Order No. 1132, dated the 6th March 1894, making over charge of the Chhindwara Forest Division to the Deputy Commissioner, Chhindwara.

8.—Burma Gazette.

24th February 1894.—No. 81.—Mr. A. Weston, Deputy Conservator of Forests, is placed in temporary charge of the Tenasserim Forest Circle, *vice* Major Bingham, proceeding on leave.

24th February 1894.—No. 8 .—In supersession of Revenue Department Notification No. 56, dated the 9th February 1894, Mr. G. F. R. Blackwell, Deputy Conservator of Forests, is transferred from Shwegyin to the charge of the Kado Forest division.

24th February 1894.—No. 83.—Revenue Department Notification No. 57, dated the 9th February 1894, transferring Mr. Ingram, Extra Assistant Conservator of Forests, from Tavoy to the charge of the Shwegyin Forest division is cancelled.

24th February 1894.—No 94.—So much of this department Notification No. 20, dated the 25th January 1894, as refers to Mr. Anthony is cancelled.

24th February 1894.—No. 85.—The following postings are ordered in the Forest Department:—

Mr. W. T. T. McHarg, from special duty in the Yaw Forest division to the charge of the Minbu Forest division.

Mr. H. B Anthony, from Thayetmyo to the charge of the Lower Chindwin Forest division.

26th February 1894 – No. 4.—With reference to Revenue Department Notifications Nos. 72 and 82 (Forests), dated respectively the 17th and 24th February 1894, Mr. G. F. R. Blackwell, Deputy Conservator of Forests, made over, and Mr. J. Messer, Assistant Conservator of Forests, received charge of, the Shwegyin division on the afternoon of the 22nd February 1894.

1st March 1894 —No. 4.—Under the provisions of section 46 of the Forest Act, 1881, Ma-ubin is hereby notified as a section for the reception of drift timber.

28th February 1894.—No. 1.—Mr. A. Weston, Deputy Conservator of Forests, made over, and Mr. G. F. R. Blackwell, Deputy Conservator of Forests, received charge of, the Kado division on the afternoon of the 28th February 1894.

6th March 1894.—No. 4.—With reference to Revenue Department Notification No. 47 (Forests), dated the 6th February 1894, Mr. C. B. Smales, Conservator of Forests, made over, and Mr. H. N. Thompson, Assistant Conservator of Forests, received charge of the Mingin subdivision, Lower Chindwin Forest Division, on the forenoon of the 26th February 1894.

26th February 1894.—No. 3.—With reference to Revenue Department Notifications Nos. 16 and 17 (Forests), dated the 23rd January 1894, Mr. J. T. Jellicoe, Deputy Conservator of Forests, Rangoon division, made over, and Mr. W. F. L. Tottenham, officiating Deputy Conservator of Forests, received charge of the Pegu division on the afternoon of the 24th February 1894.

15th February 1894.—No. 3.—Mr. H. N. Thompson, Assistant Conservator of Forests, reported his return from the three months and 15 days' privilege leave granted to him in Revenue Department Notification No. 407 (Forests), dated the 20th October 1893, at Monywa, on the forenoon of the 6th February 1894.

12*th March*, 1894.—No. 94.—Mr A. M. Burn-Murdoch, Assistant Conservator of Forests, is placed as a temporary measure in charge of the Minbu Forests division in addition to his other duties.

No. 96.—Mr. C. B. Smales, Assistant Conservator of Forests, was placed in temporary charge of the Mingin subdivision of the lower Chindwin Forest division from the 4th to the 25th February, 1894, inclusive.

No. 97.—(CORRIGENDUM).—In line 4 of the form of license prescribed in Revenue Department Notification No. 63 (Forests), dated the 13th February, 1894, *for* "the words 4 feet 2 inches in girth" *read* "2 feet 2 inches in girth."

21*st March*, 1894.—No. 103.—Under the provisions of Article 340 (*b*) of the Civil Service Regulations, furlough for 18 months is granted to Mr. C. H. Hobart-Hampden, Deputy Conservator of Forests, with effect from the 10th April, 1894, or the subsequent date on which he may avail himself of it.

No. 104.—Mr. F. J. Branthwaite, Assistant Conservator of Forests, as transferred to the Prome Forest division.

12*th March* 1894.—No. 6.—With reference to Revenue Department Notification No. 393, dated the 14th October, 1893, Mr. J. L. Lang, Extra Assistant Commissioner, relinquished charge of his duties as Forest Settlement Officer on the forenoon of the 10th March, 1894.

11.—MYSORE STATE GAZETTE

6*th March*, 1894.—No. 14,778.—G. F. 137-92.—Mr. S. A. Bapu Rao, Assistant Conservator of Forests, is appointed Head-quarter Assistant to the Inspector General of Forests, *vice* Mr T. Abdul Karim posted to the Mysore District.

No.—14,808—G 3,240.—Under Article 188 of the Mysore Service Regulations, Mr. G. Rama Rao, Forest Probationer in charge of the Shikarpur Sub-Division, was granted privilege leave of absence for one month and fifteen days from 21st November, 1893, to 4th January, 1894, both days inclusive·

No.—14,816—G. 3,249.—Under Article 188 of the Mysore Service Regulations, M. H. Muddappa, Sub-Assistant Conservator of Forests, Hassam District, is granted privilege leave of absence for 20 days from 15th March, 1894, or from such other date as he may avail himself of the same.

14*th March*, 1894.—No.15,285—G. F. 13-93.—Under Article 173 of the Mysore Service Regulations, Mr. C. E. M. Russell, Superintendent of Forests, Kadur District, has deen granted casual leave of absence for 13 days from the 3rd March, 1894.

19*th March*, 1894.—No.—15,761—G. 3,476.—Under Article 188 of the Mysore Service Regulations, Mr. Venkatanaranappa, Sub-Assistant Conservator of Forests, Tumkur District, was on privilege leave o absence for 2 months from 8th January, 1894.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

27th March, 1894 No. 354F.—With reference to the Notification of this Department, No. 199-F., dated the 15th ultimo, Mr. Ribbentrop resumed charge, on return from privilege leave, of the Office of Inspector-General of Forests, on the forenoon of 22nd March, 1894, from which date Mr. Hill reverted to his appointment of Conservator of the Central Forest Circle in the North-Western Provinces and Oudh.

11th April, 1894. No. 178F—Major C. T. Bingham, I. S. C., Conservator of Forests, 3rd grade, Tenasserim Circle, Lower Burma, is granted, under Article 282 (*a*) (i), Civil Service Regulations, privilege leave for three months and fifteen days, with effect from 1st March 1894.

2—Madras Gazette.

19th March, 1884.—The leave of absence sanctioned to Ranger R. Jambunada Sostri and notified at page 216. Part II, of the *Fort St. George Gazette,* dated 20th February 1894, is further extended up to 25th May 1894.

27th March 1894. No. 146.—Mr. R. McIntosh, District Forest Officer, Cuddapah, is granted privilege leave for three months, with effect from or after 20th April 1894, under Article 291 of the Civil Service Regulations.

2nd April, 1894. No. 148,—Mr. C. D. P. Thornton, District Forest Officer, Tinnevelly, is granted privilege leave for three months, from or after the 2nd instant, under Article 291 of the Civil Service Regulations.

2nd April, 1894. No. 150.—

No.	Name of Officer.	District.	Name of charge.
	Mr. S. C. Moss.	Tinnevelly	To act as District Forest Officer during the absence of Mr. Thornton on leave

2nd April, 1894,—R. Visvanatham Pantulu, Forest Ranger, Godavari District, is granted privilege leave for one month, with effect from 15th April 1894, or from the date of availing himself of the same.

3rd April, 1894. No. 151.—

No	Name of Officer	District.	Nature of charge.	Remarks.
1	Mr. C. G. Douglas, Deputy Conservator of Forests, First Grade.	Nilgiris	District Forest Officer.	To join on return from furlough.
2	Mr. T.G.A. Gaudoin, Extra Assistant Conservator of Forests, Fourth Grade.	Cuddapah	Acting District Forest Officer.	To act during the absence of Mr. R. McIntosh on leave.

9th April, 1894—Acting Ranger N. Nagarazu, Vizagapatam District, is reduced from Acting Ranger, 5th Grade, to Forester, 1st Grade, for three months, from 1st April 1894, * * * *

Eggia Narayana Sastri, Forester, 1st Grade, Anantapur District, is promoted to Ranger, 5th Grade, for three months, from the 1st April 1894.

11th April 1894. No. 177.—Mr. W. C. McMurray, Forest Settlement Officer, North Arcot, &c., districts, is granted privilege leave for two months, with effect from or after the 16th April 1894, under Article 291 of the Civil Service Regulations.

13th April, 1894. No. 178.—Mr. Rhodes Morgan, District Forest Officer, Nilgiris, is granted privilege leave for three months, under Article 291 of the Civil Service Regulations, with effect from the date of his relief by Mr. Douglas.

14th April 1894.—The Board of Revenue has granted one month's privilege leave, under Article 291 of the Civil Service Regulations, to Mr. H. B. Bryant, District Forest Officer, South Coimbatore, with effect from or after 2nd May next.

15th April 1894.—Mr. C. P. Howell, Sub-Assistant Conservator of Forests on Rs. 150, is granted leave on medical certificate for one year, under Article 369 of the Civil Service Regulations, with effect from the 23rd January 1894.

3.—BOMBAY GAZETTE—

31st March 1894.—Mr. Waman Ramchandra Gaunde, Extra Assistant Conservator of Forests, First Grade, returned to duty from the furlough granted to him under Government Resolution No. 8844, dated 1st December last, Revenue Department, and received charge of the Sub-Division Forest Office, Násik, on the 13th instant, before office hours.

Mr. B. H. Dalal, L C.E., Extra-Assistant Conservator of Forests, returned to duty from the privilege leave granted to him by the Conservator of Forests, C. C., in Notification dated 26th January 1894, published at page 86 of the *Bombay Government Gazette* of the 1st February 1894, and received charge of the Sub-Division Forest Office, West Khándesh, on the 12th February last, before office hours.

2nd April 1894.—Mr. W. A. Wallinger, Divisional Forest Officer, Surat, delivered over and Mr. Chunilal Gulabchand Dalia, Acting Extra Assistant Conservator of Forests, Fourth Grade, received charge of the Surat Sub-Division Forest Office on the 16th February 1894, in the afternoon.

10th April 1894. No. 2492.—Mr. W. G. Betham, Acting Deputy Conservator of Forests, First Grade, and Divisional Forest Officer, Násik, is allowed privilege leave of absence for three months from 14th Apri 1894.

11th April 1894. No. 2559.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr R. C. Wroughton, on return from leave, to do duty as Deputy Conservator of Forests in charge Northern Circle.

Mr. Fránji Rastamji Desái, on relief, to do duty as Divisional Forest Officer, Nasik, Mr. L. S. Osmaston holding charge meanwhile.

13th April 1894. No. 2627.—Mr. J. H. Clabby, Extra Assistant Conservator of Forests, Third Grade, is allowed leave on medical certificate out of India for six months.

Mr. T. B. Fry to act as Divisional Forest Officer, Dhárwár, during the absence of Mr. W. R. Woodrow, or pending further orders.

Mr. G. P. Millett to hold charge temporarily of the Working Plans Office, N. C. Thána, in addition to his own duties.

16th April 1894.—Mr. G. P. Millett, Deputy Conservator of Forests, Fourth Grade, delivered, and Mr. T. B. Fry, Deputy Conservator of Forests, Second Grade, and Divisional Forest Officer, Working Plans, N. C., received, charge of the Divisional Forest Office, West Thána, on the 10th April 1894, in the afternoon.

23rd April 1894.—Mr. E. G. Oliver, Deputy Conservator of Forests, Fourth Grade, and Divisional Forest Officer of Sholapur, having delivered over charge of his office to Mr. Waman Ramchandra Gaunde, Extra Assistant Conservator of Forests, First Grade, on the 16th instant after office hours, proceeded on one month's privilege leave granted to him.

Mr. W. G. Betham, Acting Deputy Conservator of Forests, First Grade, and Divisional Forest Officer of Nasik, having delivered over charge of his office on the 13th instant, after office hours, to Mr. L. S. Osmaston, Divisional Forest Officer, Working Plans, proceeded on three months' privilege leave granted to him under Government Resolution No. 2492, dated 10th idem, in the Revenue Department.

24th April 1894.—Messrs. B. H. Dalal, L.C.E., and Vaman Gopal Tumn respectively delivered over and received charge of the Sub-Division Forest Office, West Khandesh, on the 10th instant, after office hours.

Mr. Waman Ramchandra Gaunde, Sub-Divisional Forest Officer of Násik, delivered over, and Mr. Vishnu Mahadeo Tilak, Acting Extra Assistant Conservator of Forests, received, charge of the Nasik Sub-Division Office on the 12th instant, after office hours.

Mr. Vishnu Mahadeo Tilak having been appointed Acting Extra Assistant Conservator of Forests, Fourth Grade, under Government Resolution No. 2174, dated 26th March 1894, in the Revenue Department, reported himself for duty to the undersigned in his new appointment, on the 27th idem, before office hours.

4.—BENGAL GAZETTE—

16th April 1894. No. 2,077.—In continuation of Notification No. 168For., dated the 10th January 1894, it is hereby notified that Mr. F. Trafford, Assistant Conservator of Forests, has been granted a further extension of leave for six days, without pay, by the Secretary of State.

19th April 1894 No 2213.—Mr. R. Quinnell, Extra Assistant Conservator of Forests, in charge of the Chittagong Forest Division, is granted three months' privilege leave, under Article 291 of the Civil Service Regulations, with effect from the 30th April 1894, or any subsequent date on which he may avail himself of it.

23rd April 1894. No. 2257.—Mr. H. H. Davis, Deputy Conservator of Forests, 1st grade, having been appointed to officiate as Conserva tor of Forests, 3rd grade, and to take charge of the Bengal Forest Circle until relieved by Mr. A. E. Wild, the following promotions are hereby made in the Upper Controlling Staff of the Forest Department in Bengal, with effect from the 23rd February 1894 :—

Mr. E. G. Chester, Deputy Conservator of Forests, 2nd grade, to officiate in the first grade of Deputy Conservators.

Mr. G. A. Richardson, Deputy Conservator of Forests, 3rd grade, to officiate in the 2nd grade of Deputy Conservators.

Mr. R L. Heinig, Deputy Conservator of Forests, 4th grade, to officiate in the 3rd grade of Deputy Conservators.

Mr. W. H, Lovegrove, Assistant Conservator of Forests, 1st grade, to officiate in the 4th grade of Deputy Conservators.

23*rd April* 1894. No. 2258.—Mr. A. E. Wild, Officiating Conservator of Forests, 2nd grade, and Conservator of Forests, 3rd grade, having assumed charge of the Bengal Forest Circle on the afternoon of the 7th April 1894, the following reversions of officers of the Upper Controlling Staff of the Bengal Forest Department are hereby ordered, with effect from that date :—

Mr. H. H. Davis, Officiating Conservator of Forests, 3rd grade, to revert to the 1st grade of Deputy Conservators.

Mr. E. G. Chester, Officiating Depnty Conservator of Forests, 1st grade, to revert to the 2nd grade of Deputy Conservators.

Mr. G. A. Richardson, Officiating Deputy Conservator of Forests, 2nd grade, to revert to the 3rd grade of Deputy Conservators.

Mr. R. L. Heinig, Officiating Deputy Conservator of Forests, 3rd grade, to revert to the 4th grade af Deputy Conservators.

Mr. W. H. Lovegrove, Officiating Deputy Conservator of Forests, 4th grade, to revert to the 1st grade of Assistant Conservators.

5.—N. W.-P. and Oudh Gazette.

10*th April* 1894. No. $\frac{1201}{11-651B}$. —Lála Har Swarup, Extra Assistant Conservator of Forests, from the Bahraich to the Gorakhpur Forest Division in the Oudh Circle.

6.—Punjab Gazette.

11*th April* 1894. No. 229—Bhái Sadhu Singh, Extra Assistant Conservator of Forests, Punjab, is posted to the Jhelum Forest Division for work in connection with the Forest Settlement of Rakhs in the Shahpur District, with effect from the afternoon of the 23rd March 1894.

7.—Central Provinces Gazette.

29*th March* 1894. No. 1554.—Mr. L. A. W. Rind, Deputy Conservator of Forests, Narsingpur, availed himself, on the afternoon of the 8th instant, of the two months and twenty-nine days' privilege leave granted him by Order No. 636, dated the 8th February 1894, making over charge of his duties to Mr. Mahomed Kadar Baksh, Extra Assistant Conservator.

5th April 1894. No 1671 —With reference to Order No. 1133, dated the 6th ultimo, Mr. W. G. Gilmore, Forest Ranger, and the Deputy Commissioner, Chhindwara, respectively assumed and surrendered charge of the Chhindwara Forest Division on the forenoon of the 21st ultimo.

5th April 1894. No. 1672.—Mr. P. H. Clutterbuck, Officiating Deputy Conservator of Forests, and Working Plans Officer, availed himself, on the forenoon of the 5th ultimo, of the six months' leave on urgent private affairs granted him by Order No. 1132, dated the 6th March 1894, making over charge of the Chhindwara Forest Division to the Deputy Commissioner, Chhindwara.

Mr. Clutterbuck reported his departure from Bombay on the 20th ultimo

Order No. 1490, dated the 21st March 1894, is hereby cancelled.

10th April 1894. No. 1744 —Dr. E. Dobbs, Deputy Conservator of Forests, in charge of the Nagpur-Wardha Forest Division, is appointed to hold charge of the current duties of the office of Conservator of Forests, Southern Circle, Central Provinces, in addition to his own duties, with effect from the date of receiving charge from Colonel Doveton.

12th April 1894. No. 1811.—Mr. W. P. Thomas, Deputy Conservator of Forests, Hoshangabad, availed himself, on the afternoon of the 21st March 1894, of subsidiary leave preparatory to the one year's furlough granted him under Order No. 1226, dated the 8th March 1894, making over charge of the Hoshangabad Forest Division to Mr. A. M. F. Caccia, Assistant Conservator of Forests.

No. 1812.—Mr. W. P. Thomas, Deputy Conservator of Forests, reported his departure from Bombay per P. & O. s.s. *Clyde*, on the 24th March 1894, on one year's furlough.

8—Burma Gazette.

24th March 1894. No. 7.—With reference to Revenue Department Notification No. 20F., dated the 25th January 1894, Mr. H. B. Anthony, Deputy Conservator, made over, and Mr. F. W. Thellusson, Deputy Conservator, received, charge of the Thayetmyo Forest division on the forenoon of the 20th March 1894.

26th March 1894. No 5.—With reference to Revenue Department Notification No. 94 (Forests), dated the 12th March, 1894 Mr. F. W. Thellusson, Deputy Conservator of Forests, made over, and Mr. A. M. Burn-Murdoch, Assistant Conservator of Forests, received, charge as a temporary measure of the Minbu Forest division on the forenoon of the 18th March 1894 in addition to his other duties.

26th March 1894. No. 112.—Mr. C. S. Rogers, Temporary Forest Ranger, is appointed to be an Extra Assistant Conservator of Forests, 4th grade.

30th March 1894. No. 6.—With reference to Revenue Department Notification No. 85 (Forests), dated the 24th February 1894, Mr. A. M. Burn-Murdoch, Assistant Conservator of Forests, made over, and Mr. W. T. T. McHarg, Assistant Conservator of Forests, assumed, charge of the Minbu Forest division on the afternoon of the 26th March 1894.

3rd April 1894 No. 7.—With reference to the Revenue Department Notification No. 85 (Forests), dated the 24th February 1894, M. T. H. Aplin, Deputy Conservator of Forests, made over, and Mr. H. B. Anthony, Deputy Conservator of Forests, assumed, charge of the Lower Chindwin Forest Division on the forenoon of the 31st March 1894.

4th April 1894. No. 133.—Mr. F. J. Branthwaite, Assistant Conservator of Forests, was on special duties in the Toungoo Forest division from the 16th January to the 21st March 1894, both days inclusive.

6th April 1894. No. 136.—Mr F. B. Dickinson, Deputy Conservator of Forests, reported his arrival in Rangoon on the 6th April 1894, before noon.

10th April 1894. No. 8.—Preparatory to his retirement from service Maung We, Extra Assistant Conservator of Forests, made over, and Mr. E B. Powell, Extra Assistant Conservator of Forests, received, charge of the South Tharrawaddy subdivision on the afternoon of the 4th April 1894.

1.th April 1894. No. 147.—Mr. A. L. Home, Conservator of Forest, Western Circle, was placed in charge of the Direction division of the Eastern Circle from the 9th March to the 7th April 1894, both days inclusive, in addition to his other duties.

16th April 1894. No. 2.—Mr. G. F. R. Blackwell, Deputy Conservator of Forests, made over, and Mr. A. Weston, Deputy Conservator of Forests, received, charge of, the Kado division, on the forenoon of the 14th April 1894.

9.—Assam Gazette.

17th April 1894. No. 2730.—In consequence of the departure on furlough of Babu Jogesvar Sur, Extra Assistant Conservator of Forests, Fourth Grade, Babu Nilkanta Mukharji, Forest Ranger, Fifth Grade, is appointed to officiate as an Extra Assistant Conservator of Forests, Fourth Grade, with effect from the 1st April 1894.

20th April 1894. No. 3943G.—Babu Nilkanta Mukharji, Officiating Extra Assistant Conservator of Forests, Fourth Grade, is placed temporarily in charge of the Kamrup Forest Division, *vice* Mr. H. G. Young, Deputy Conservator of Forests, who was granted furlough for one year in Notification No. 1644G., dated the 20th February 1894. Notification No. 1645G., dated the 20th February 1894, published at page 126 of the *Assam Gazette* of the 24th idem, is hereby cancelled.

10.—Hyderabad Residency Gazette.

22nd March 1894. No. 99.—Mr. W. G. J. Peake, Forest Ranger, is appointed to be a Probationary Extra Assistant Conservator of Forests in Berar on Rs 150 per mensem, with effect from the 10th January 1894.

11.—Mysore State Gazette.

27th March 1894. No. 16251G. 3581—Under Article 181 of the Mysore Service Regulations, Mr. C. Narain Rao, Assistant Conservator of Forests, Shimoga, is granted privilege leave of absence for one and a half months from the 22nd instant

2. Mr. B. Srinivasa Rao, Sub-Assistant Conservator of Forests, Shikarpur Sub-Division, is appointed to act as Assistant Conservator of Forests, 3rd Grade, during the absence of Mr. C. Narain Rao on privilege leave, or until further orders.

3. Mr. C. Appaiya, Forest Probationer, Shimoga District, will be in charge of the Shikarpur Sub-Division during the absence of Mr. B. Srinivasa Rao on other duty.

17th April 1894. No. 17552G. 3854.—The two months' privilege leave granted to Mr. Venkatnaranappa, Sub-Assistant Conservator of Forests, Tumkur District, in Notification No. 15768—3476, dated 19th March 1894, is hereby extended by 9 days.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

3rd May, 1894.—No. 443-F.—In consequence of the death of Mr. R. H. C. Whittall, Conservator of Forests, 2nd grade, Punjab :—

Mr. A. E. Wild, Conservator, 3rd (officiating 2nd) grade, is confirmed in the 2nd grade.

Mr. P. J. Carter, Conservator, 3rd grade, Pegu Circle, Lower Burma, is appointed to officiate in the 2nd grade.

Mr. J. A. McKee, Deputy Conservator, 1st grade, Central Provinces, and Officiating Conservator, 3rd grade, is confirmed in the latter grade.

With effect from 23rd February 1894.

Mr. E. Forrest, Deputy Conservator, 2nd grade, Punjab, officiated as Conservator, 3rd grade, in charge of the Punjab Forest Circle, from 26th February to 31st March 1894, both dates inclusive.

Mr. C. F. Elliott, Deputy Conservator, 1st grade, Beluchistan, is appointed Officiating Conservator, 3rd grade, Punjab, with effect from 1st April 1894, and until further orders.

Mr. A. M. Reuther, Deputy Conservator, 3rd grade, Punjab, is transferred temporarily to Baluchistan, *vice* Mr. Elliott, with effect from 26th March 1894.

No. 449-F.—The following reversions are ordered with effect from 22nd March 1894 :—

Mr. C. Bagshawe, Conservator of Forests, 2nd (officiating 1st) grade, Berar, to his substantive grade.

Mr. P. J. Carter, Conservator, 3rd (officiating 2nd) grade, Pegu Circle, Lower Burma, to his substantive grade.

No. 452-F.—Mr. J. A. McKee, Conservator of Forests, 3rd grade, Assam, is granted leave on medical certificate for eight months under Article 269 of the Civil Service Regulations, together with such subsidiary leave as may be admissable to him with effect from 2nd April 1894.

Mr. A. Smythies, Deputy Conservator, 2nd grade, North-Western Provinces and Oudh, and Deputy Director of the Imperial Forest School, is appointed Officiating Conservator, 3rd grade, Assam, with effect from 2nd April 1894, and until further orders.

Mr. J. Nisbet, Deputy Conservator, 1st grade, Burma, is appointed Deputy Director of the Imperial Forest School, with effect from 6th April 1894, and until further orders.

No. 457-F.—With reference to the Notification of this Department, No. 309-F., dated the 8th March last, Mr. A. E. Wild, Conservator, 2nd grade, relieved Mr. H. H. Davis, Officiating Conservator, 3rd grade, of charge of the Bengal Forest Circle, with effect from 8th April 1894, from which date Mr. Davis reverted to his substantive appointment of Deputy Conservator, 1st grade.

No. 459-F.—Mr. J. W. Oliver, Conservator of Forests, 2nd grade, Eastern Circle, Upper Burma, availed himself on the afternoon of 31st March 1894, of the furlough granted him in the Notification of this Department, No. 294-F., dated the 28th February last.

Mr. P. J. Carter, Conservator 3rd grade, Pegu Circle, Lower Burma, is appointed to officiate in the 2nd grade, with effect from 1st April 1894, and until further orders.

Mr. T. H. Aplin, Deputy Conservator, 2nd grade, Burma, officiated as Conservator, 3rd grade, in charge of the Eastern Forest Circle, from 1st to 8th April 1894, both dates inclusive.

Mr. F. B. Dickinson, Deputy Conservator, 1st grade, Central Provinces, is appointed, on return from the furlough granted him in the Notification of this Department, No 339-F., dated 17th March 1893, to officiate as Conservator, 3rd grade, in charge of the Eastern Forest Circle, Upper Burma, with effect from 9th April 1894, and until further orders.

Mr. A Weston, Deputy Conservator, 3rd grade, Burma, officiated as Conservator, 3rd grade, in charge of the Tenasserim Forest Circle, Lower Burma, *vice* Major Bingham on privilege leave, from 1st March to 12th April 1894, both dates inclusive.

Mr. Aplin, Deputy Conservator, 2nd grade, Burma, is appointed to officiate as Conservator, 3rd grade, in charge of the Tenasserim Forest Circle, with effect from 13th April 1894, and until Major Bingham's return from leave.

11*th May*, 1894.—No. 507-F.—The services of Colonel J. C. Doveton, M. S. C., Conservator of Forests, Southern Circle, Central Provinces, are replaced at the disposal of the Military Department, with effect from the 10th April 1894.

25*th May*, 1894.—No. 564-F.,—With reference to the Notification of this Department, No. 507-F, dated the 11th May 1894, replacing the services of Colonel J. C. Doveton, M. S. C., Conservator of Forests, 1st grade, Southern Circle, Central Provinces, at the disposal of the Military Departement, with effect from the 10th April 1894 :—

Mr. C. Bagshawe, Conservator, 2nd grade, Berar, is promoted to the 1st grade.	With effect from 10th April 1894.
Mr. R. H. E. Thompson, Conservator, 3rd (officiating 2nd) grade, Northern Forest Circle, Central Provinces, is confirmed in the 2nd grade.	

Major C. T. Bingham, Conservator, 3rd grade, Tenasserim Circle, Lower Burma, is appointed to officiate in the 2nd grade, with effect from 10th April 1894, and until further orders.

2.—MADRAS GAZETTE.

20*th April*, 1894.—Ranger C. Subramania Aiyar, from North Arcot District to the Cuddapah District.

M. Callanan, upon relief by C. Subramania Aiyar, from the Cuddapah District to the North Arcot District.

25*th April*, 1894.—Ranger V. C. Doraiswami Pillai will be considered to have been on leave on medical certificate, under Article 869 of the Civil Service Regulations, for fourteen days, from 23rd March 1894.

24th April, 1894.—No. 193.—Mr. C E. Brasier, District Forest Officer, Salem, is granted privilege leave for two months and twenty days, with effect from or after the 1st May 1894. under Article 291 of the Civil Service Regulations.

2nd May, 1894.—Mr. M. S. Noronha. Ranger on Rs. 60, South Canara, is granted privilege leave on medical certificate for six weeks, under Article 291 of the Civil Service Regulations, from 12th March 1894.

2nd May, 1894.—The following are the results for the Government students from the Southern Circle who went up to the Dehra Dun School in 1892:—

M. Panchapikesa Iyer, Forester, on Rs. 30, obtained the Higher Standard Certificate with Honours.

Mr. E. A. Monisse, Forester, on Rs. 40, obtained the Higher Standard Certificate.

Syed Edulla Saib, Acting sub. *pro tem.* Forester, on Rs. 30 obtained the Higher Standard Certificate.

Mr. C. V. Ryan, Forester, on Rs 40, obtained the Higher Standard Certificate.

T. V. Armugam Pillai, Acting sub. *pro tem.* Forester, on Rs. 30, obtained the Higher Standard Certificate.

C. S. Jesudasen Pillai, Acting sub. *pro tem.* Forester, on Rs. 30, obtained the Higher Standard Certificate.

5th May, 1894.—No 205.—In continuation of the leave notified at page 1002 of Part I of the *Fort St George Gazette*, dated 29th August 1893, Mr. C. G. Douglas, Deputy Conservator of Forests, Madras, has been granted an extension of leave, without allowances, up to the 23rd April 1894.

17th May, 1894.—No. 209.—

No.	Name of officers.	District.	Nature of charge.	Remarks.
1	Mr. F. C. L. Cowley-Brown, Assistant Conservator of Forests, 2nd Grade.	Salem	District Forest Officer.	To act during Mr. Brasier's absence on leave or until further orders.

17th May, 1894.—*Leave on medical certificate*—To Ranger T. Narayanaswami Aiyer, North Arcot, for 47 days, from 8th April 1894, under article 369 of the Civil Service Regulations.

19th May, 1894.—No. 223.—

No.	Name of Officers.	District.	Nature of charge.	Remarks.
...	Mr. H. H. Ward, Extra Assistant Conservator of Forests, Fourth Grade, Godavari.	Godavari.	Acting District Forest Officer.	During the absence of Mr. A. B. Jackson on privilege leave, or until further orders.

19th May, 1894.—No. 220.—Mr. A. B. Jackson, District Forest officer, Godavari, is granted privilege leave for three months, with effect from or after the 20th Jnne 1894 under Article 291 of the Civil Service Regulations.

3.—BOMBAY GAZETTE.

25th April, 1894.—Mr. C. Greatheed, Divisional Forest Officer East Thana, delivered over, and Mr. A. N. Master, Extra Assistant Conservator of Forests, Fourth Grade, received, charge of, the Sub-Division Forest Office, Shahapur, on the 17th April 1894, before noon.

30th April, 1894.—Mr. A. N. Master, Extra Assistant Conservator of Forests, Fourth Grade, delivered over, and Mr. W. F. D. Fisher, Assistant Conservator of Forests, Second Grade, received, charge of the Divisional Forest Office, Panch Mahals, on the 12th of April 1894, in the afternoon.

30th April, 1894.—Mr. Lakshman Dai Joshi, Extra Assistant Conservator of Forests, First Grade, received charge of the Sub-Division Forest Office, Poona, from Mr. J. H. Clabby on the 21st of March last, after office hours.

2nd May, 1894.—No. 3064.—Mr. Balwant Ganesh Deshpande, Divisional Forest Officer, Ratnagiri, and Mr. Ganesh Sakharam Hinge, Extra Assistant Conservator of Forests, Satara, passed with credit, and Mr. Ardeshir Nasarvanji Master, L. C. E. Divisional Forest Officer in charge Panch Mahals, and Mr. A. C. Robinson, L. C. E., Sub. Divisional Forest Officer, Kolaba, passed an examination in Marathi according to the Lower Standard on the 16th April 1894.

Mr. W. F. D. Fisher, Assistant Conservator of Forests, Panch Mahals, passed an examination in Gujarati according to the Lower Standard on the 16th April 1894.

Mr. Nanabhai Dadabhai Sataravala, L. C. E., Extra Assistant Conservator of Forests, Working Plans Party II. S. C., passed an examination in Kanarese according to the Lower Standard on the 16th April 1894.

No. 3065.—Mr. Balwant Ganesh Deshpande, Divisional Forest Officer, Ratnagiri, Mr. Ganesh Sakharam Hinge, Extra Assistant Conservator of Forests, Satara, and Mr. Ardeshir Nasarvanji Master, L. C. E., Divisional Forest Officer in charge Panch Mahals, passed an examination in Marathi according to the Higher Standard on the 16th April 1894.

Mr. W. F. D. Fisher, Assistant Conservator of Forests, Panch Mahals, passed an examination in Gujarati according to the Higher Standard on the 16th April 1894.

Mr. Nanabhai Dadabhai Sataravala, L. C. E., Extra Assistant Conservator of Forests, Working Plans Party II, S. C., passed an examination in Kanarese according to the Higher Standard on the 10th April 1894.

8th May, 1894.—Messrs. L. S. Osmaston, Deputy Conservator, Fourth Grade, and F. R. Desai, Deputy Conservator, First Grade, respectively delivered over and received charge of the Divisional Forest Office, Nasik, on the 2nd instant, before office hours.

10*th May*, 1894.—Mr. T. B. Fry, Deputy Conservator of Forests, Second Grade, delivered over, and Mr. G. P. Millett, Deputy Conservator of Forests, Fourth Grade, received, charge of the Divisional Forest Office, Working Plans, Northern Circle, on the 10th of May 1894, before noon.

12*th May*, 1894.—Mr. W. R. Woodrow, Deputy Conservator of Forests and Divisional Forest Officer, Dharwar, availed himself of the furlough granted to him in Government Resolution No. 1638, dated 2nd March 1894, on the 5th instant, after Office hours, handing over his charge to Mr. J. Fairlie Muir, Collector, Dharwar.

15*th May*, 1894.—No. 4281.—His Excellency the Governor in Council is pleased to make the following appointments in the Forest Department:—

Mr. E. G. Oliver, on return from leave, to be Working Plans Divisional Forest Officer, Kanara.

Mr. C. M. Hodgson, on return from leave, to be Divisional Forest Officer, Sholapur.

15*th May*, 1894.—Mr. T. B. Fry, Deputy Conservator of Forests, Second Grade, and Mr. G. P. Millett, Deputy Conservator of Forests, Fourth Grade, respectively delivered over and received charge of the Divisional Forest Office, West Thana, on the 10th of May 1894, before noon.

16*th May*, 1894.—Mr. Krishnaji Babji Phadke, Extra Assistant Conservator of Forests, Fourth Grade, and Sub-Divisional Forest Officer, Kalyan, has been granted one month's privilege leave from the 6th of May 1894.

16*th May*, 1894.—Mr. K. B. Phadke, Assistant Conservator of Forests, Fourth Grade, and Mr. A. N. Master, Extra Assistant Conservator of Forests, Fourth Grade, and Sub-Divisional Forest Officer, Shahapur, respectively delivered over and received charge of the Sub-Division Office, Kalyan, on the 8th of May 1894, in the afternoon.

16*th May*, 1894.—With reference to Government Resolution No. 2025, dated 17th March 1894, Mr. Waman Gopal Tumne, Acting Extra Assistant Conservator of Forests, Fourth Grade, reported his arrival for duty in the West Khandesh Division on the 5th April last, after office hours.

18*th May*, 1894.—Mr. T. B. Fry, Deputy Conservator of Forests, took over charge of the Dharwar Forest Division from Mr. J. Fairlie Muir, Collector, Dharwar, on the forenoon of the 14th instant.

22*nd May*, 1894.—No. 4502.—The undermentioned officers passed on the 16th April 1894 the examination in Law prescribed in Rule 4 of the Rules published in Government Notification No. 2, dated 3rd January 1894, for the examination of officers of the Forest Department:—

Passed with Credit.

(1) **Mr. Ganesh Sakharam Hinge, Extra Assistant Conservator of Forests, Satara,**

Passed.

(2) Mr. Balwant Ganesh Deshpande, Divisional Forest Officer, Ratnagiri.

(3) Mr W. F. D. Fisher, Assistant Conservator of Forests, Panch Mahals.

The names are arranged in the order of merit.

23*rd May*, 1894.—Mr. Waman Ramchandra Gaunde, Extra Assistant Conservator of Forests, First Grade, and Mr. E. G. Oliver, Deputy Conservator of Forests, Fourth Grade, respectively delivered over and received charge of the Divisional Forest Office, Sholapur, on the 16th instant, after office hours, on the return of the latter officer from the privilege leave of one month which had been granted to him.

4.—BENGAL GAZETTE.

26*th April* 1894.—No. 2350.—Mr. F. Trafford, Assistant Conservator of Forests, on return to duty from leave is posted to the charge of the Chittagong Forest Division, *vice* Mr. R. Quinnell, Extra Assistant Conservator of Forests, on privilege leave.

8*th May*, 1894.—No. 2551.—Mr. E. G. Chester, Deputy Conservator of Forests, in charge of the Singhbhum Division, is granted one month's privilege leave, under Article 291 of the Civil Service Regulations, with effect from the 1st May 1894, or any subsequent date from which he may avail himself of it.

14*th May*, 1894.—No. 2653.—Mr. J. C. Mendes, Extra Assistant Conservator of Forests, attached to the Singhbhum Division, is granted one year's furlough, under Article 371 (*a*) of the Civil Service Regulations, with effect from 1st May 1894, or any subsequent date on which he may avail himself of it.

5.—N.-W. P. AND OUDH GAZETTE.

29*th May*, 1894.—No. 1869.—Babu Karuna Nidhan Mukharji, Extra Assistant Conservator of Forests, in charge of the Gonda Forest Division, in the Oudh Circle, privilege leave for three months, with effect from the 25th May 1894.

29*th May*, 1894.—No. 1870.—Lala Har Swarup, Extra Assistant Conservator of Forests, attached to the Bahraich Forest Division, in the Oudh Circle, to the charge of the Gonda Forest Division in the same circle, during the absence on leave of Babu Karuna Nidhan Mukharji, or until further orders.

6.—PUNJAB GAZETTE.

2*nd May*, 1894.—No. 268.—With reference to Government of India, Revenue and Agricultural Department, Notification No. 45 F., dated 10th January 1894, Mr. H. S. K. Edie, Officiating Assistant Conservator of Forests, 1st Grade, was transferred from the Central Provinces to Assam with effect from the 10th January 1894.

3*rd May*, 1894.—No. 272.—Mr. C. P. Fisher, Officiating Deputy Conservator of Forests, on return from three months' privilege leave granted him in *Punjab Government Gazette* Notification No. 580, dated 15th November 1893, assumed charge of the lu Forest Division from Mr. E. M. Coventry, Assistant Conser-or of Forests, on the forenoon of the 12th April 1894.

5th *May*, 1894.—No. 278.—Consequent on his transfer to luchistan, Mr. A. M. Reuther, Deputy Conservator of Forests, de over charge of the Kulu Forest Division to Mr. E. M. Coventry, sistant Conservator of Forests, on the afternoon of 15th March 894.

8th *May* 1894.—No. 282—Mr. C. F. Rossiter, Extra Assistant Conservator of Forests, 2nd Grade, is reduced to the top of the 3rd Grade of Extra Assistant Conservator of Forests, with effect from the 6th April 1894.

7.—CENTRAL PROVINCES GAZETTE.

24th *April*, 1894.—No. 2017.—With reference to Order No. 1744, dated the 10th April 1894, Colonel Doveton and Dr. E. Dobbs respectively made over and assumed charge of the current duties of the office of Conservator of Forests, Southern Circle, Central Provinces, on the afternoon of the 9th instant.

24th *April*, 1894.—No. 2047.—With the sanction of Her Majesty's Secretary of State for India, Mr. M Muttannah, Extra Assistant Conservator of Forests, 1st Grade, is appointed to be an Extra Deputy Conservator of Forests, 4th grade (supernumerary) on the Provincial Branch of the Upper Controlling Staff, with effect from the 1st April 1893.

14th *May*, 1894.—No 2.—The following passed stipendiary students of the Imperial Forest School, Dehra Dun, having complied with the conditions laid down in Section 29 (1) of the Forest Department Code, 4th Edition, are appointed Forest Rangers, 6th grade, on a salary of Rs. 50 per mensem, with effect from the 1st April 1894, and are posted to the Forest Division noted against their respective names:—

Mr. Shanker Nath	... Jubbulpore.
Mr. J. F. Anthony	... Saugor.
Mr. J. D. St. Joseph	... Betul.
Mr. C A. Webb	... Hoshangabad.

16th *May* 1894.—No 2310.—Mr. C. O. Hanson, Assistant Conservator of Forests, attached to the Direction Division, Southern Circle, is posted to the Nagpur-Wardha Division as Working-Plans Assistant.

15th *May* 1894.—No. 2311.—With reference to Order No. 2310, dated the 16th instant, Mr. C. O. Hanson relinquished charge of his duties in the Direction Division and assumed charge of his duties as Working-Plans Assistant on the forenoon of the 1st April 1894.

16th *May*, 1894.—No. 2312.—Mr. F. Linnell, Assistant Conservator of Forests, attached to the Direction Division, Southern Circle. is posted to the Seoni Division as Working-Plans Assistant.

16th *May*, 1894.—No. 2313.—With reference to Order No. 2312, dated the 15th instant, Mr. F. Linnell relinquished charge of his duties in the Direction Division on the forenoon of the 7th ultimo and assumed charge of his duties at Seoni on the forenoon of the 16th idem.

8.—BURMA GAZETTE—

23rd April 1894.—No. 159.—In the last line of Revenue D partment Notification No. 91, dated the 8th March 1894, *for* "Salwe division" *read* "Salween-Attaran division."

23rd April 1894.—No. 160.—Mr. F. J. Branthwaite, Officiati Deputy Conservator of Forests, is posted to the charge of the Pro Forest division.

No. 9.— With reference to Revenue Department Notifications No 103 and 104, dated the 21st March 1894, Mr. C. H. Hobart-Hampden Deputy Conservator of Forests, made over, and Mr. F. J. Branthwait Officiating Deputy Conservator of Forests, received, charge of the Prom division on the afternoon of the 18th April 1894.

26th April 1894.—Mr. C. R. Dun, Assistant Conservator of Forests, is appointed to be Personal Assistant to the Conservators of Forests, Eastern and Western Circles, and is posted to the charge of the Direction Division, Mandalay.

27th April 1894.—No. 167—Mr. D. H. Allan, temporary Forest Ranger, is appointed to be an Extra Assistant Conservator of Forests, on probation, and is transferred from the Pyinmana Forest division to the charge of the Gangaw subdivision of the Yaw Forest division.

30th April 1894—No. 3—With reference to Revenue Department Notification No. 492 (Forests), dated the 13th December 1893, Mr. C. R. Dun, Assistant Conservator of Forests, reported his return from special duty in the Shwebo district on the afternoon of the 19th April 1894.

No. 4.—With reference to Revenue Department Notification No. 166 (Forests), dated the 20th April 1894, Mr. C.R. Dun, Assistant Conservators of Forests, assumed charge of his duties, as Personal Assistant to the Conservators of Forests, Eastern and Western Circles, on the forenoon of the 23rd April 1894.

3rd May 1894.—No. 3.—Mr. C. Ingram, Lxtra Assistant Conservator of Forests, made over, and Mr. G. F. R. Blackwell, Deputy Conservator of Forests, received charge of, the South Tenasserim division on the afternoon of the 24th April 1894.

4th May 1894.—No. 175.—Mr. C. Ingram, Extra Assistant Conservator of Forests, is transferred to Rangoon and posted to special duty in the office of the Conservator of Forests, Pegu Circle.

No. 177—Under the provisions of Article 282 (*a*) (*i*) of the Civil Service Regulations privilege leave for three months and 15 days is granted to Mr. A. M. Burn-Murdoch, Assistant Conservator of Forests with effect from the 6th May 1894, or the subsequent date on which he may avail himself of it.

No. 178.—Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, is transferred from the Mayadaung subdivision of the Katha Forest division to the charge of the Magwe subdivision of the Minbu Forest division.

8th May 1894.—No. 10—With reference to Revenue Department Notification No. 175, dated the 4th May 1894, Mr. C. Ingram, Extra Assistant Conservator of Forests, was on special duty in this office from the forenoon of the 4th to the forenoon of the 8th May 1894, when he proceeded to Port Blair.

9th May 1894.—No. 183.—Under the provisions of Article 282 [illegible] (*i*) of the Civil Service Regulations privilege leave for three months d 15 days is granted to Mr. C. R. Dun, Assistant Conservator of rests, with effect from the 1st June 1894, or the subsequent date which he may avail himself of it.

.—ASSAM GAZETTE.

27th April. 1894.—No. 3096G.—Privilege leave of absence for one day, under Article 291 of the Civil Service Regulations, is granted to Mr. H. G. Young, Deputy Conservator of Forests, in extension of the leave granted in Notification No. 698J., dated the 2nd February 1893.

10th May 1894.—No. 3432G.—The following is published :—

The undermentioned officer has been granted by Her Majesty's Secretary of State for India permission to return to duty, as advised in List dated the 6th April 1894 :—

Name.	Service	Appointment	Date on which permitted to return.
Mr. W. F. Lloyd ...		Deputy Conservator of Forests, Assam.	Within period of leave.

18th May 1894.—No. 3647G.—On the report of the Central Examination Committee, the Chief Commissioner directs the publication, for general information, of the results of the Half-yearly Examination of Assistant Commissioners, Extra Assistant Commissioners, and other officers held on the 7th, 8th, 9th, 10th, and 11th, May 1894 :

Name.	Subjects taken up by Candidates.		Subjects in which passed.		Compulsory subjects in which still required to pass.	
	Higher Standard.	Lower Standard.	Higher Standard.	Lower Standard.	Higher Standard.	Lower Standard.
FOREST OFFICERS.						
Mr. A. M. Long	Assamese ...	....	Assamese ...	.. ..	.. ..	....
,, F. E. B. Lloyd ...	Forest Law.		Procedure and Accounts. ...		Assamese ..	....
	Procedure and Accounts.				Land Revenue.	
					Forest Law.	
Babu Tara Kisor Gupta ...	Procedure and Accounts		Procedure and Accounts		....	....
,, Kripa Nath De ...	Assamese ...	....	Assamese ...	....	Forest Law.	
	Land Revenue,		Land Revenue.		Procedure and Accounts.	

NOTE.—The last two columns are not meant to embody an exhaustive list of all the subjects and standards in which officers are liable to pass, and do not relieve any officer liable to examination, whether mentioned in this Notification or not, from the duty of ascertaining for himself the subjects and standards in which he is required to pass.

* The subjects marked with an asterisk are optional subjects, *i. e.*, not necessary to the retention of the officer's substantive appointment.

25th May 1894—No. 3799G.—In continuation of Notification No. 3647G., dated the 18th May 1894, the Chief Commissioner directs, on the report of the Central Examination Committee, the publication of the results of the Half-yearly Examination held on the 8th and 10th May 1894 of the Forest Officer named below :

Name.	Subject taken up by the candidate.		Subjects in which passed.		Compulsory subjects in which still required to pass.	
	Higher Standard.	Lower Standard.	Higher Standard.	Lower Standard.	Higher Standard.	Lower Standard.
Babu Upendra Nath Kanjilal, Extra Assistant Conservator of Forests.	Procedure and Accounts, Forest Law.		Procedure and Accounts (with distinction). Forest Law (with distinction)		Assamese. Land Revenue.	

11.—MYSORE GAZETTE.

2nd May 1894.—No. 18301.—G. 4021.—Under Article 173 of the Mysore Service Regulations, Mr. B. Ramaswami Iyer, Sub-Assistant Conservator of Forests, Kolar District, was on casual leave for 11 days from the 21st of March 1894.

15th May 1894.—No. 19520—G. 4370.—The 1½ months' privilege granted to Mr. C. Narayana Rao, Assistant Conservator of Forests, in Notification No 16251—G 3581, dated 27th March 1894, is hereby extended by one month.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

28th May, 1894—No. 397 Home.—Mr. C. G. D. Fordyce, Deputy Conservator of Forests, Port Blair, is appointed to be an Assistant Superintendent in the Settlement, with effect from the 31st December 1892, for so long as he holds his present office, or until further orders.

15th June, 1894—No. 630-F.—With reference to the Notification of the Foreign Department, No. 927-G., dated the 7th instant, Mr E. E. Fernandez, Deputy Conservator of Forests, 1st grade, Assam, is granted furlough for two years, under Article 340 (*b*) Civil Service Regulations, with effect from 8th June 1894. Mr. Fernandez availed himself of subsidiary leave from 1st to 7th idem, both dates inclusive.

2.—Madras Gazette.

29th May, 1894.—Mr. E. J. D. Pierce, Ranger on Rs. 50, Madura District, is granted privilege leave for three months, under Article 291 of the Civil Service Regulations, from the date on which he may be relieved by his District Forest Officer.

7th June, 1894.—The leave of absence sanctioned to Ranger M. Jambunatha Sastriar and notified at page 517, Part II, of the *Fort St. George Gazette* of 3rd April 1894, is further extended up to 25th August 1894 inclusive.

9th June, 1894 *No.* 273.—

No.	Name of officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	Mr. C. D. McArthy	Assistant Conservator of Forests, 1st grade.	Deputy Conservator of Forests, 4th grade.	Permanent	With effect from date Gazette.
2	Mr. C. DuPré Thornton	Do. ...	Do.	Do.	Do.

9th June, 1894.—To T. Arumuga Mudaliar, Ranger, 5th grade North Arcot District, for two months, under Article 291 of the Civil Service Regulations, from date of *relief*.

15th June, 1894.—Mr. J. Tapp, Forest Ranger, North Arcot District, will continue to act in the 4th grade up to 25th August 1894 inclusive, *vice* M. Jambunatha Sastriar on leave.

9*th June*, 1894.—*No.* 278.—

No.	Name of officer.	District.	Nature of charge.	Remarks.
1	Mr. R. W. Morgan, Deputy Conservator of Forests, 1st grade.	Tinnevelly	District Forest Officer.	To join on return from privilege leave.
2	Mr. C. DuPrè Thornton, Deputy Conservator of Forests, 4th grade.	Vizagapatam ...	Do.	Do.

21*st June*, 1894.—Ranger Narayanaswami Aiyar is transferred from North Arcot to Trichinopoly.

3.—BOMBAY GAZETTE.—

1*st June*, 1894.—No. 4781.—His Excellency the Governor in Council is pleased to attach Mr. G. R. Duxbury, Assistant Conservator of Forests, to the Poona Division for the monsoon months or till further orders

4*th June*, 1894.—No. 4817.—His Excellency the Governor in Council is pleased to confer upon Mr. B. H. Dalal, Extra Assistant Conservator of Forests, 2nd grade, and Divisional Forest Officer, Sukkur, the powers mentioned in Section 67 of the Indian Forest Act, No. VII of 1878, as amended by Section 13 of Act No. V of 1890.

4*th June*, 1894.—No. 4819.—Mr. K. B. Phadke, Extra Assistant Conservator of Forests, 4th grade, and Sub-Divisional Forest Officer, Kalyàn, is allowed privilege leave of absence for two months from 9th May 1894.

5*th June*, 1894.—Messrs. Vishnu Mahadev Tilak and Waman Ramchandra Gaundé respectively delivered over and received charge of the Nasik Sub-Division Forest Office on the 24th May last, before office hours.

9*th June*, 1894.—No. 4971.—Mr. W. S. Hexton. Deputy Conservator of Forests, Sind Circle, is allowed privilege leave of absence for two months and twenty-eight days from 28th June 1894, or from such subsequent date as he may avail himself thereof.

9*th June*, 1894.—No. 4971 A.—His Excellency the Governor in Council is pleased to appoint Mr. G. M. Ryan to act as Deputy Conservator of Forests, Sind Circle, in addition to his own duties, during the absence of Mr. W. S. Hexton on privilege leave or pending further orders.

9*th June*, 1894.—No. 5069.—*Erratum.*—In Government Notification No. 4281, dated 15th May 1894, published at page 446 of the *Bombay Government Gazette* of the 17th idem, Part I, *for* "Mr. E. G. Oliver, on return from leave, to be Working Plans Divisional Forest Officer, Kanara," *read* "Mr. E. G. Oliver, on return from leave, to be Divisional Forest Officer, Working Plans Party No. 1, Southern Circle."

9th June, 1894.—No. 5070.—Mr. V. R. Gaundi, Extra Assistant Conservator of Forests, 1st grade, was appointed to do duty as Divisional Forest Officer, Sholápur, during the absence of Mr. E. G. Oliver, Deputy Conservator of Forests, 4th grade, on privilege leave of absence for one month from 17th April 1894.

12th June, 1894.—Mr. Vishnu Mahadev Tilak, Acting Extra Assistant Conservator of Forests, after having delivered over charge of the Sub-Division Forest Office, Násik, to Mr. Waman Ramchandra Gaunde, reported himself for duty to the Divisional Forest Officer of Poona on the 26th ultimo, before office hours.

14th June, 1824.—Mr. G. R. Duxbury, Assistant Conservator of Forests, who has been attached to the Poona Division under Government Resolution No. 4781, dated 1st instant, reported himself for duty to the Divisional Forest Officer of Poona on the 9th idem, before office hours.

20th June, 1894.—Mr. H. Mitra, Extra Assistant Conservator, delivered over, and Mr. E. G. Oliver, Deputy Conservator, received, charge of the Divisional Forest Office, Working Plans Party No. I, S. C., on the forenoon of the 19th June 1894.

4.—Bengal Gazette.

1st June, 1894.—No. 2910.—In supersession of the orders contained in the Notification No. 2551 For., dated the 8th May 1894, Mr. E. G. Chester, Deputy Conservator of Forests, in charge Singhbhum Forest Division, is granted furlough for one year under Article 340 (*b*) of the Civil Service Regulations, with effect from the 10th May 1894.

1st June, 1894.—No. 2911.—Mr. W. H. Lovegrove, Assistant Conservator of Forests, attached to the Singhbhum Forest Division, is placed in charge of that Division, with effect from the afternoon of the 9th May 1894, *vice*, Mr. Chester, on furlough.

18th June, 1894.—No. 199T.—Mr. C. A. G. Lillingston, Deputy Conservator of Forests, attached to the Darjeeling Division, is transferred to the Direction Division and appointed Personal Assistant to the Conservator of Forests, Bengal, with effect from the 1st June 1894.

25th June, 1894.—No. 1032.—The report of the Central Examination Committee having been received, the result of the Half-yearly Departmental Examination of Assistant Magistrates and others, held in May 1894, is published for general information :—

1. Mr. A. H. Mee, Extra Assistant Conservator of Forests, has passed in Forest Law.

2. Mr. E P. Stebbing, Assistant Conservator of Forests, has passed in Forest Law and Forest Procedure and Accounts.

3. Mr. F. Trafford, Assistant Conservator of Forests, has passed in Forest Law.

5.—N.-W. P. and Oudh Gazette.

12th June, 1894.—No. 1983.—Pandit Raghu Nath Pathak, Extra Assistant Conservator of Forests, from the Direction to the Garhwál Division of the Central Circle.

12*th June*, 1894.—No. 1986.—Mr. E. L. Haslett, Extra Assistant Conservator of Forests, from the Direction to the the Naini Tal Division of the Central Circle.

16*th June*, 1894.—No. 2035.—The undermentioned officer has been granted by Her Majesty's Secretary of State for India extension of leave :—

Name.	Service.	Appointment.	Period and nature of leave.
Mr. L. Mercer	Forest	Deputy Conservator of Forests.	Three months' leave on medical certificate.

25*th June*, 1894.—No. 2119.—Pundit Sadanand, Extra Assistant Conservator of Forests, from the charge of the Dehra Dún Forest Division to that of the Saharanpur Forest Division, in the School Circle.

25*th June*, 1894.—No. 2123.—Mr. H. G. Billson, Assistant Conservator of Forests, attached to the Direction Division of the School Circle, to the charge of the Dehra Dun Forest Division.

6.—PUNJAB GAZETTE.

25*th June*, 1894.—No. 343.—With reference to Punjab Government Notification No. 229 of 11th April 1894, Bhài Sádhu Singh, Extra Assistant Conservator of Forests, on termination of his duties in connection with the Forest Settlement of Rakhs in the Shahpur District, is posted to the Hazàra Forest Division, with effect from the forenoon of the 5th May 1894.

25*th June* 1894.—No. 344—Consequent on the promotion of Mr. J. A. McKee, Deputy Conserva or of Forests, 1st grade, to Conservator of Forests, 3rd grade (*vide Government of India Gazette* Notification No. 443 F. of 3rd May 1894), and on the transfer of one post of Deputy Conservator of Forests, 4th grade, from the list of Forest Officers in the amalgamated provinces (*vide* orders contained in Government of India No. 276 F., dated 24th February 1894 to Secretary to Chief Commissioner, Central Provinces) the following changes will have effect from the 23rd of February 1894 :—

Mr. G. G. Minniken, Provisional Deputy Conservator of Forests, 1st grade, to be Deputy Conservator of Forests, 1st grade.

Mr. W. P. Thomas, Officiating Deputy Conservator of Forests, 1st grade, to be Provisional Deputy Conservator of Forests, 1st grade.

Mr. G. F. Prevost, Provisional Deputy Conservator of Forests, 2nd grade, to be Deputy Conservator of Forests, 2nd grade.

Mr. J. Ballantine, Deputy Conservator of Forests, 3rd grade, on furlough, to be Provisional Deputy Conservator of Forests, 2nd grade.

Mr. J. H. Lace, Provisional Deputy Conservator of Forests, 3rd grade, on furlough, to be Deputy Conservator of Forests, 3rd grade.

Mr. L. G. Smith, Officiating Deputy Conservator of Forests, 3rd grade, to be Provisional Deputy Conservator of Forests, 3rd grade.

Mr. C. P. Fisher, on privilege leave, Officiating Deputy Conservator of Forests, 4th grade, to be Assistant Conservator of Forests, 1st grade.

Mr. A. V. Monro, Officiating Deputy Conservator of Forests, 4th grade, to be Assistant Conservator of Forests, 1st grade.

25th June 1894.—No. 346.—Consequent on the appointment of Mr. E. Forrest, Officiating Deputy Conservator of Forests, 1st grade, to officiate as Conservator of Forests, 3rd grade (*vide Government of India Gazette* Notification No. 443-F., dated 3rd May 1894,) the following promotions will have effect from the 26th February 1894:—

Mr. L. A. W Rind, Deputy Conservator of Forests, 2nd grade, to officiate as Deputy Conservator of Forests, 1st grade.

Mr. A. M. Reuther, Deputy Conservator of Forests, 3rd grade, to officiate as Deputy Conservator of Forests, 2nd grade.

Mr. H. A. Hoghton, Deputy Conservator of Forests, 4th grade, to officiate as Deputy Conservator of Forests, 3rd grade.

Mr. C. P. Fisher, on privilege leave, Assistant Conservator of Forests, 1st grade, to officiate as Deputy Conservator of Forests, 4th grade.

Mr. A. V. Monro, Assistant Conservator of Forests, 1st grade, to officiate as Deputy Conservator of Forests, 4th grade.

25th June 1894.—No, 347.—Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st grade, proceeded on special leave for six months, with effect from the 5th March 1894.

25th June 1894.—No. 348.—Consequent on the departure on privilege leave for 2 months and 27 days of Mr. L. A. W. Rind, Officiating Deputy Conservator or Forests, 1st grade, the following promotions shall have effect from the 9th March 1894:—

Mr. F. O. Lemarchand, Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 1st grade,

Mr. L. G. Smith, Provisional Deputy Conservator of Forests, 3rd grade, to officiate in addition as Deputy Conservator of Forests, 2nd grade.

Mr. H. Calthrop, Deputy Conservator of Frrests, 4th grade, to officiate as Deputy Conservator of Forests, 3rd grade.

Mr. A. W. Blunt, Assistant Conservator of Forests, 1st grade, to officiate as Deputy Conservator of Forests, 4th grade.

25th June 1894.—No. 349.—Consequent on the departure on furlough for one year of Mr. W. P. Thomas, Provisional Deputy Conservator of Forests, 1st grade, the following promotions shall have effect from 24th March 1894:—

Mr. G. F. Prevost, Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 1st grade.

Mr. H. Moore, Officiating Deputy Conservator of Forests, 3rd grade, to Officiating Deputy Conservator of Forests, 2nd grade.

Mr. F. C. Hicks, Provisional Deputy Conservator of Forests. 4th grade, to officiate in addition as Deputy Conservator of Forests, 3rd grade.

Mr. A. M. F. Caccia, Officiating Assistant Conservator of Forests, 1st grade, to Officiating Deputy Conservator of Forests, 4th grade.

25th June 1894,—No, 350.—Consequent on the reversion of Mr. E. Forrest, Officiating Conservator, to his substantive appointment, and on the promotion of Mr. C. F. Elliott, Deputy Conservator, 1st grade, to Officiating Conservator, 3rd grade (*vide* Government of India Notification No. 443 F., dated 3rd May 1894).

Mr. E. Forrest, Deputy Conservator of Forests, 2nd grade, to officiate as Deputy Conservator of Forests, 1st grade, with effect from 1st April 1894.

25th June 1894.—No. 351.—Mr. F. B. Dickinson, Deputy Conservator of Forests, 1st grade, returned from one year's furlough on 9th April 1894, and was appointed to officiate as Conservator of Forests, 3rd grade, from that date (*vide* Government of India Notification No. 459 F., dated 3rd May 1894.)

25th June 1894.—No. 352.—Consequent on the return of Mr. C. P. Fisher, Officiating Deputy Conservator of Forests, 4th grade, from privilege leave the following reversion shall have effect from 12th April 1894 :—

Mr. A. M. F. Caccia, Officiating Deputy Conservator of Forests, 4th grade, to Officiating Assistant Conservator of Forests, 1st grade.

25th June 1894.—No. 353.—Consequent on the return of Mr. L. A. W. Rind, Officiating Deputy Conservator of Forests, 1st grade, from privilege leave, the following reversions shall have effect from 6th June 1894:—

Mr. G. F. Prevost, Officiating Deputy Conservator of Forests, 1st grade, to Deputy Conservator of Forests, 2nd grade.

Mr. H. Moore, Officiating Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 3rd grade.

Mr. F. C. Hicks, Provisional Deputy Conservator of Forests, 4th grade, and Officiating Deputy Conservator of Forests, 3rd grade, to Provisional Deputy Conservator of Forests, 4th grade.

Mr. A. W. Blunt, Officiating Deputy Conservator of Forests, 4th grade, to Assistant Conservator of Forests, 1st grade.

25th June 1894.—No. 354.—Consequent on the departure on one year's furlough of Mr. H. A. Hoghton, Deputy Conservator of Forests, 4th grade, and Officiating Deputy Conservator of Forests, 3rd grade, the following promotions shall have effect from 9th June 1894 :—

Mr. F. C. Hicks, Provisional Deputy Conservator of Forests, 4th grade, to officiate in addition as Deputy Conservator of Forests, 3rd grade.

Mr. A. W. Blunt, Assistant Conservator of Forests, 1st grade, to Officiating Deputy Conservator of Forests, 4th grade.

7—CENTRAL PROVINCES GAZETTE.

29th May 1894.—No. 1.—The following passed stipendiary student of the Imperial Forest School, Dehra Dun, having complied with the conditions laid down in Section 29 (1) of the Forest Department Code, 4th Edition, is appointed a Forest Ranger, 6th grade, on a salary of Rs. 50 per mensem, with effect from the 1st April 1894, and is posted to the Forest Division noted against his name :—

Vithal Dhondu	...	Nagpur-Wardha.

29th May 1894.—No. 2.—The following passed private student of the Imperial Forest School, Dehra Dun, having complied with the conditions laid down in Section 29 (1) of the Forest Department Code, 4th Edition, is appointed a Forest Ranger, 6th grade, on probation, on a salary of Rs. 50 per mensem, with effect from the 17th May 1894, and is posted to the Forest Division noted against his name :—

K. Rama Rao ... Chanda.

5th June 1894.—No. 2624.—Furlough for one year, under Article 840 (*b*) of the Civil Service Regulations, is granted to Mr. H. A. Hoghton, Deputy Conservator of Forests, Seoni Division, with effect from the 1st June 1894, or from the subsequent date on which he may avail himself of it.

7th June 1894.—No. 2639.—Mr. R. C. Milward, Assistant Conservator of Forests and Working-Plans Assistant, Betul Forest Division, is transferred in the same capacity to the Hoshangabad Forests Division.

20th June 1894.—No. 2802.—On return from the privilege leave granted him by Order No. 636, dated the 8th February last, Mr. A. L. W. Rind, Deputy Conservator of Forests in the Northern Circle, is posted to the charge of the Seoni Forest Division in the Southern Circle, Central Provinces, *vice* Mr. H. A. Hoghton, Deputy Conservator of Forests proceeding on furlough.

21st June 1894.—No. 2806.—Mr. H. A. Hoghton, Deputy Conservator of Forests, Seoni, availed himself, on the forenoon of the 9th June 1894, of subsidiary leave preparatory to the one year's furlough granted him by Order No. 2624, dated the 5th June 1894, making over charge of the Seoni Forest Division to the Deputy Commissioner, Seoni.

21st June 1894.—No. 2841.—With reference to Order No. 2802, dated the 20th instant, Mr. L. A. W. Rind, Deputy Conservator of Forests, assumed charge of the Seoni Forest Division on the forenoon of the 15th instant.

14th June 1894.—No. 3.—With the previous approval and sanction of the Chief Commissioner, Central Provinces, Mr. J. D. St. Joseph, Forest Ranger, 6th grade, in the Betul Forest Division, is appointed as a Working-Plans Assistant, Betul, with effect from the 12th May 1894, *vice* Mr. Milward, Assistant Conservator of Forests and Working-Plans Assistant, transferred in the same capacity to the Hoshangabad Division.

8—Burma Gazette.

19th May 1894. No. 206.—The following transfers of officers of the Forest Department in the Upper Chindwin Forest division are ordered :—

Mr. H. H. Forteath, Assistant Conservator of Forests, from Paungbyin to the charge of the Kindat Revenue subdivision.

Mr. C. W. Allan, Extra Assistant Conservator of Forests, on being relieved by Mr. H. H. Forteath, Assistant Conservator of Forests, to the charge of the Paungbyin subdivision.

19th May 1894, No. 207—Under the provision of Article 282 (*a*) (1) of the Civil Service Regulation, privilege leave for three months and 15 days is granted to Mr. W. F. L. Tottenham, Officiating Deputy Conservator of Forests, with effect from the 31st May 1894, or the subsequent date on which he may avail himself of it.

19*th May*, 1894, No. 208.—Mr. H. Carter, Officiating Deputy Conservator of Forests, is transferred from the Working Plans division to the charge of the Pegu Forest division, *vice* Mr. Tottenham, proceeding on leave.

21*st May* 1894, No. 211.—In this Department Notification No. 183 (Forests), dated the 9th May 1894, *for* the words "1st June 1894" *read* "30th May 1894."

24*th May* 1894, No. 212.—Mr. T. A. Hauxwell, Deputy Conservator of Forests, is posted as a temporary measure to the charge of the Kado Forest division in addition to his other duties.

24*th May* 1894, No. 213.—Under the provisions of Article 282 (*a*) (*i*) of the Civil Service Regulations privilege leave for three months and 15 days is granted to Mr. G. R. Long, Assistant Conservator of Forests, with effect from the 1st June 1894, or the subsequent date on which he may avail himself of it.

24*th May* 1894, No. 214—In exercise of the powers conferred by section 70 of the Burma Forest Act, 1881, the Chief Commissioner withdraws from Mr. L. D'Rozario, Forest Ranger, 1st grade, Salween-Attaran division, Tenasserim Circle, the powers with which he was specially invested in Revenue Department Notification No. 119 (Forests), dated the 21st August 1889.

24*th May* 1894, No. 215.—In exercise of the powers conferred by section 70 of the Burma Forest Act, 1881, the Chief Commissioner invests Maung Charlie, Forest Ranger, 5th grade, Kado division, with the following powers, that is to say:—

(1) The powers of a Civil Court to compel the attendance of witnesses and the production of documents.

(2) Power to issue search warrants under Code of Criminal Procedure.

(3) Power to hold enquiries into forest offences, and in the course of such enquiries to receive and record evidence.

25*th May* 1894, No. 217—Mr. C. W. B. Anderson, Extra Assistant Conservator of Forests, is placed under suspension, with effect from the date of this order.

29*th May* 1894, No. 222.—The following alterations in rank are ordered in the Forest Department:—

(1) With effect from the 6th February 1894, the date on which Mr. H. N. Thompson, Assistant Conservator, 2nd (officiating 1st) grade, returned from privilege leave.

Mr. H. H. Forteath, Assistant Conservator, 2nd (officiating 1st) grade, to revert to his substantive appointment.

(2) With effect from the 1st March 1894, the date on which Major C. T. Bingham availed himself of privilege leave:

Mr. C. E. Muriel, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. E. A. O'Bryen, Assistant Conservator, 1st grade, to officiate as Deputy Conservator, 4th grade.

Mr. H. H. Forteath, Assistant Conservator, 2nd grade, to officiate as Assistant Conservator, 1st grade.

(3) With effect from the 1st April, the date on which Mr. J. W. Oliver availed himself of leave:

Mr. F. W. Thellusson, Deputy Conservator, 2nd grade, to officiate as Deputy Conservator, 1st grade.

Mr. J. C. Murray, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. G. Q. Corbett, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. W. F. L. Tottenham, Assistant Conservator, 1st grade, to officiate as Deputy Conservator, 4th grade.

Mr. G. R. Long, Assistant Conservator, 2nd grade, to officiate as Assistant Conservator, 1st grade.

(4) With effect from the 6th April, the date on which Mr. J. Nisbet was appointed Deputy Director of the Imperial Forest School:—

Mr. T. H. Aplin, Deputy Conservator, 2nd grade, to be Deputy Conservator, 1st grade.

Mr. E. S. Carr, Deputy Conservator, 3rd grade, to be Deputy Conservator, 2nd grade.

Mr. H. B. Anthony, Deputy Conservator, 4th grade, to be Deputy Conservator, 3rd grade.

Mr. F. J. Branthwaite, Assistant Conservator, 1st grade, to be Deputy Conservator, 4th grade.

Mr. C. R. Dun, Assistant Conservator, 2nd grade, to be Assistant Conservator. 1st grade.

Mr. G. R. Long, Assistant Conservator, 2nd (officiating 1st) grade to revert to his substantive appointment.

(5) With effect from the 9th April 1894, the date on which Mr. F. B. Dickinson assumed charge of the Eastern circle:

Mr. T. H. Aplin, Deputy Conservator, 1st grade, Officiating Conservator, to revert to his substantive appointment.

Mr. F. W. Thellusson, Deputy Conservator, 2nd (officiating 1st) grade, to revert to his substantive appointment.

Mr. J. C. Murray, Deputy Conservator, 3rd (officiating 2nd) grade, to revert to his substantive appointment.

Mr. G. Q. Corbett, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive appointment.

Mr. W. F. L. Tottenham, Assistant Conservator, 1st grade, Officiating Deputy Conservator, 4th grade, to revert to his substantive appointment.

Mr. H. H. Forteath, Assistant Conservator, 2nd (officiating 1st) grade, to revert to his substantive appointment.

(6) With effect from the 13th April 1894, the date on which Mr. T. H. Aplin assumed charge of the Tenasserim Circle:

Mr. F. W. Thellusson, Deputy Conservator, 2nd grade, to officiate as Deputy Conservator, 1st grade.

Mr. A. Weston, Deputy Conservator, 3rd grade, officiating Conservator, to officiate as Deputy Conservator, 2nd grade.

(7) With effect from the 19th April 1894, the date on which Mr. C. H. Hobart-Hampden availed himself of furlough:

Mr. G. Q. Corbett, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. W. F. L. Tottenham, Assistant Conservator, 1st grade, to officiate as Deputy Conservator, 4th grade.

Mr. H. H. Forteath, Assistant Conservator, 2nd grade, to officiate as Assistant Conservator, 1st grade.

29th May 1894, No. 5.—Mr. C. R. Dun, Assistant Conservator of Forests, availed himself of the privilege leave granted to him in Revenue Department Notification No. 183 (Forests), dated the 9th May 1894, on the afternoon of the 29th May 1894.

30th May 1894, No. 223.—Mr. H. H. Forteath, Assistant Conservator of Forests, is appointed to be Personal Assistant to the Conservators of Forests, Eastern and Western Circles, and is transferred from Kindat to the charge of the Direction Division, Mandalay, *vice* Mr. C. R. Dun, proceeding on leave.

30th May 1894, No 4.—With reference to Revenue Department Notification No. 212 (Forests), dated the 24th May 1894, Mr. A. Weston, Deputy Conservator of Forests, made over, and Mr. T. A. Hauxwell, Deputy Conservator of Forests, received charge of, the Kado division on the afternoon of the 30th May 1894.

31st May 1894, No. 228.—Mr. R. F Lowis, Extra Assistant Conservator of Forests, is transferred from the Ruby Mines subdivision of the Katha Forest Division to the charge of the Magwe subdivision of the Minbu Forest Division.

Revenue Department Notification No. 178, dated the 4th May 1894, is hereby cancelled.

2nd June 1894, No. 9.—Mr. A. M. Burn-Murdoch, Assistant Conservator of Forests, made over charge, on the afternoon of the 6th May 1894, of the Magwe subdivision, Minbu division, to Forest Ranger Maung Po Tah, as a temporary measure, and availed himself on the forenoon of the 7th May 1894 of the three months and 15 days' privilege leave granted him in Revenue Department Notification No. 177 (Forests), dated the 4th May 1894.

4th June 1894. No. 5.—Mr. G. R. Long, Assistant Conservator of Forests, availed himself of the three months and 15 days' privilege leave granted to him in Notification No. 213 (Forests), dated the 24th May 1894, on the afternoon of the 4th June.

6th June 1894, No. 11.—With reference to Revenue Department Notification No. 207 (Forests), dated the 19th May 1894, Mr. W. F. L. Tottenham, Officiating Deputy Conservator of Forests, made over, and Mr. H Carter, Officiating Deputy Conservator of Forests received charge of, the Pegu division on the afternoon of the 31st May 1894.

No. 12.—With reference to Revenne Department Notification No. 208 (Forests), dated the 19th May 1894, Mr. H. Carter, officiating Deputy Conservator of Forests, relinquished charge of the Working Plans division on the afternoon of the 31st May 1894.

7th June 1894. No. 10.—With reference to Revenue Department Notification No. 206 (Forests), dated the 19th May 1894:—

Mr. H. H. Forteath, Assistant Conservator of Forests, made over, and Mr. C. W. Allan, Extra Assistant Conservator of Forests, received charge of, the Paungbyin subdivision, Upper Chindwin division, on the afternoon of the 28th May 1894.

Mr. C. W. Allen, Extra Assistant Conservator of Forests, made over, and Mr. C. W. A. Bruce, Assistant Conservator of Forests, received charge of, the Kindat revenue subdivision, Upper Chindwin division, on the forenoon of the 31st May 1894.

7th June 1894, No. 11.—With reference to the Revenue Department Notification No. 228 (Forests), dated the 30th May 1894, Mr. H. H. Forteath, Assistant Conservator of Forests, reported his arrival at Mandalay, and assumed charge of the duties as Personal Assistant to the Conservators of Forests, Eastern and Western Circles, on the forenoon of the 7th June 1894.

8th June 1894, No. 235.—The following alterations in rank are ordered in the Forest Department:—

(1) With effect from the 1st April 1894, the date on which Mr. J. W. Oliver availed himself of leave:

Mr. A. F. Gradon, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

(2) With effect from the 9th April 1894, the date on which Mr. F. B. Dickinson assumed charge of the Eastern circle;

Mr. A. F. Gradon, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive appointment.

(3) With effect from the 19th April 1894, the date on which Mr. C. H. Hobart-Hampden availed himself of furlough:

Mr. A. F. Gradon, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

11th June 1894, No. 238.—Under the provisions of Section 69 of the Forest Department Code, examination leave for 10 days is granted to Mr. W. A. Hearsey, Extra Assistant Conservator of Forests, with ffect from the 23rd May 1894.

12th June 1894, No. 6.—With reference to Revenue Department Notification No. 217, dated the 25th May 1894, Mr. C. W. B. Anderson made over, and Mr. F. J. Rivett, Forest Ranger took over charge of, the Mandalay Revenue subdivision on the afternoon of the 5th June 1894.

16th June 1894, No. 243.—Under the provisions of Article 282 (*a*) (*i*) of the Civil Service Regulations privilege leave for three months and 15 days is granted to Mr. H. Jackson, Deputy Conservator of Forests, with effect from the 15th July 1894, or the subsequent date on which he may avail himself of it.

19th June 1894, No. 246.—Under the provisions of Article 282 (*a*) (*i*) of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. C. E. Muriel, Deputy Conservator of Forests, with effect from the 1st July 1894, or the subsequent date on which he may avail himself of it.

No. 247.—Mr. S. Carr, Assistant Conservator of Forests, is transferred from Yaméthin to the charge of the Pyinmana Forest division during Mr. Muriel's absence on leave or until further orders.

No. 248.—On being relieved by Major C. T. Bingham of the charge of the Tenasserim Forest Circle Mr T. H. Aplin, Deputy Conservator of Forests, is posted to the charge of the Kado Forest division.

20th June 1894, No. 249.—Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, is transferred from Kyauksè to the Pyinmana Forest sub-division.

No. 252.—The Chief Commissioner directs that from the date of this notification the Myittha-Panlaung subdivision of the Mandalay Forest division shall be known as the Kyauksè sub-division.

9—ASSAM GAZETTE.

29*th* *May* 1894, No. 3861G.—In consequence of the departure on furlough of Mr. H. G. Young, Deputy Conservator of Forests, 3rd grade (provisional), Mr. T. J. Campbell, Deputy Conservator of Forests, 4th grade, is appointed to officiate, until further orders, as Deputy Conservator of Forests, 3rd grade, with effect from the 4th April 1894.

11*th* *June* 1894, No. 4188.—With effect from the 11th May 1894, Babu Tara Kisor Gupta, Extra Assistant Conservator, 3rd grade, to be Extra Assistant Conservator, 2nd grade.

15*th* *June* 1894. No. 4272.—Mr. W. F. Lloyd, Deputy Conservator of Forests, 4th grade, on return from leave, is placed on special duty, and attached to the Office of the Conservator of Forests.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

11*th July*, 1894.—No, 702-*F*.—With reference to the Notification of this Department, No. 564-F., dated the 25th May last, Mr. G. G. Minniken, Deputy Conservator of Forests, 1st grade, Punjab, is transferred to the Central Provinces, and appointed to officiate as Conservator, 3rd grade, in charge of the Southern Forest Circle, with effect from the 5th July 1894, and until further orders.

Mr. Dobbs, Deputy Conservator, 3rd grade, Central Provinces, held charge of the Southern Forest Circle, in addition to his own duties, from 10th April to 4th July 1894, both dates inclusive.

17*th July*, 1894.—No. 734-*F*.—In the Notification of this Department, No. 142-F., dated the 26th January last, ordering certain transfers in the interests of the public service, *for* "Mr. F S. Barker, Deputy Conservator, 4th grade, Central Provinces, (on furlough)," *substitute* "Mr. H. A. Hoghton, Deputy Conservator, 4th grade, Central Provinces."

2.—Madras Gazette.

26*th June*, 1894.—No. 308—Mr. A. W. Peet, Conservator of Forests, Northern Circle, is granted privilege leave for one month and twelve days, with effect from or after the 1st July 1894, under Article 291 of the Civil Service Regulations, 2nd edition.

28*th June*, 1894.—No. 310.—M. R. Ry. T, M. Nullasami Naidu Garu, Acting District Forest Officer, Bellary, is granted privilege leave for three months, with effect from the date of his relief, under Article 291 of the Civil Service Regulations.

28*th June*, 1894.—No. 314.—

No.	Name and designation of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	**Mr. F. C. L. Cowley-Brown, Acting District Forest Officer, Salem.**	**Assistant Conservator of Forests, 2nd Grade.**	**Assistant Conservator of Forests, 1st Grade.**	**Permanent**	**To take effect from 16th December 1893.**

28*th June*, 1894.—No. 315.—

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion.	Remarks showing cause of vacancy, &c.
1	M.R. Ry. M. Rama Row	Ranger, 4th Grade, acting in the 3rd Grade.	Extra Assistant Conservator, 4th Grade.	Permanent	
2	Mr. H. O'Neill ...	Ranger, 1st Grade.	Do. ..	Acting ...	During the absence of Mr. Carroll on furlough, or until further orders.
3	Mr. W R. Newman	Do. ...	Do. ...	Do. ...	During the absence of Mr. Hardie on furlough, or until further orders.

28*th June*, 1894.—Mr. W. R. Newman, Ranger, 1st grade, is reduced for two months to Ranger, 2nd grade.

29*th June*, 1894.—R. Visvanadham Pantulu, Forest Ranger, 2nd grade, Godavari District, is promoted to the 1st grade for two months from 1st July 1894, *vice* Mr. W. R. Newman, reduced.

30*th June*, 1894.—The following transfer is ordered in the Northern Circle on public service :—

M. Balaji Singh, Forest Ranger, 5th grade, from Anantapur to Kistna District. To join forthwith.

5*th July*, 1894.—With effect from the 1st July 1894, 2nd grade Forester Saiyid Burhanuddin Husain is promoted to act as Ranger, 5th grade, sub. *pro tem.*

5*th July*, 1894.—No. 325.—

No.	Name of Officer.	Present grade.	Grade to which promoted.	Nature of promotion	Remarks showing cause of vacancy, &c.
	Mr. H. B. Bryant	Assistant Conservator of Forests, 1st Grade.	Deputy Conservator of Forests, 4th Grade.	Permanent	With effect from 18th July 1894.

7*th July*, 1884.—The transfer of Mr. S. C. Moss, Extra Assistant Conservator of Forests, 2nd grade, from Tinnevelly to South Canara, notified on page 216 of the *Fort St. George Gazette*, dated 20th February 1894, Part II, will be held in abeyance for the present.

9*th July*, 1894.—No, 324.—The appointment of Mr. W. R. Newman to act as Extra Assistant Conservator of Forests, notified at page 805 of Part I of the *Fort St. George Gazette*, dated 3rd July 1894, is hereby cancelled.

13th *July*, 1894.—No. 347.—

No.	Name of officer.	District.	Nature of charge.	Remarks.
	Mr. R. W. Morgan, Deputy Conservator of Forests, 1st Grade.	South Canara	Acting District Forest officer.	During the absence of Mr. Foulkes on privilege leave, or until further orders. To join on return from leave.

NOTE.—This cancels Notification No. 300 in *Fort St. George Gazette* of 26th June.

14th *July*, 1894.—*Leave without pay.*—Ranger Vencatakrishnama Naidu will be considered to have been on leave without pay and allowances from the 30th April to the 5th May 1894 inclusive.

14th *July*, 1894.—No. 344.—Mr. F. Foulkes, District Forest Officer, South Canara, is granted privilege leave for two months, with effect from or after 1st August 1894, under Article 291 of the Civil Service Regulation.

19th *July*, 1894.—No. 357.—Mr. W. Carrol, Extra Assistant Conservator of Forests, Madras, has been granted by the Right Honorable the Secretary of State for India an extension of twelve months' furlough, in continuation of the furlough granted to him under Notification No. 468, published at page 1081 of Part I of the *Fort St. George Gazette*, dated 19th September 1893.

3.—BOMBAY GAZETTE.

27th *June*, 1894.—No. 5483.—His Excellency the Governor in Council is pleased to make the following appointments in the Forest Department :—

Mr. W. G. Betham, on return from leave, to be Divisional Forest Officer, Kolaba

Mr. A. Stewart, on relief, to be Divisional Forest Officer, Panch Mahals.

And to attach Mr. W. F. D. Fisher, on relief, to the Nasik Division, till further orders.

29th *June*, 1894.—No 5527.—His Excellency the Governor in Council is pleased to transfer Mr. Vaman Ramchandra Gaunde, Extra Assistant Conservator of Forests, to the Northern Circle.

4th *July*, 1892.—Mr. E. G. Oliver, Deputy Conservator of Forests, Fourth Grade, and Mr. C. M. Hodgson, Assistant ConserAator of Forests, respectively delivered over and received charge of the Sholapur Divisional Forest Office on the 13th June 1894, before office hours.

16th *July*, 1892. Mr. K B. Phadke, Extra Assistant Conservator of Forests, Fourth Grade, having returned from the two months' privilege leave granted him under Government Resolution No. 4819, dated 4th June last, took over charge of the Sub-Division Forest Office, Kalyan, from Mr. A. N. Master, Sub-Division Forest Officer, Shahapur, on the afternoon of the 9th of July 1894.

4.—BENGAL GAZETTE.

3rd July, 1893.—No. 3357.—The following officiating promotions are sanctioned with effect from the 10th May, 1894, in the Upper Controlling Staff of the Forest Department in Bengal, during the absence, on leave, of Mr. E. G. Chester, Deputy Conservator of Forests, 2nd grade, or until further orders :—

1. Mr. G. A. Richardson, Deputy Conservator of Forests, 3rd grade, to officiate in the 2nd grade of Deputy Conservators.

2. Mr. R. L. Heinig, Deputy Conservator of Forests, 4th grade, to officiate in the 3rd grade of Deputy Conservators.

3. Mr. W. H. Lovegrove, Assistant Conservator of Forests, 1st grade, to officiate in the 4th grade of Deputy Conservators.

16th July, 1894.—No. 3555.—Mr. H. D. D. French, Deputy Conservator of Forests, in charge of the Tista Division, is allowed leave for three months, under Article 291 of the Civil Service Regulations, with effect from the 6th August 1894, or any subsequent date on which he may avail himself of it.

20th July, 1894.—No. 3692.—Mr. W. F. Perree, Assistant Conservator of Forests, attached to the Darjeeling Forest Division, is granted three months' examination leave under Section 69 of the Forest Department Code, with effect from the 1st August 1894, or from any subsequent date on which he may avail himself of it.

5.—N.-W. P. AND OUDH GAZETTE.

10th July, 1894.—No. 2355.—Col. J. E. Campbell, Deputy Conservator of Forests, in charge of the Garhwal Forest Division of the Central Circle, privilege leave for three months, with effect from the 24th July 1894.

10th July, 1894.—No. 2356.—Babu Raghu Nath Pathak, Extra Assistant Conservator of Forests, attached to the Garhwal Forest Division of the Central Circle, to the charge of that Division during the absence on leave of Colonel J. E. Campbell, or until further orders.

26th July, 1894.—No. 2503.—Mr. M. Hill, Officiating Deputy Conservator of Forests, in charge of the Kheri Forest Division of the Oudh Circle, privilege leave for three months, with effect from the 13th August 1894.

26th July, 1894.—No. 2504.—Mr. J. M. Blanchfield, Extra Assistant Conservator of Forests, in charge of the Pilibhit Forest, Division of the Oudh Circle, to the charge of the Kheri Forest Division of the same circle, in addition to his own duties, during the absence on leave of Mr. M. Hill, or until further orders.

6.—PUNJAB GAZETTE.

9th July, 1894.—No. 367.—Mr. E. M. Coventry, Assistant Conservator of Forests, Punjab, is granted three months' privilege leave of absence under Articles 277 and 291 of the Civil Service Regulations with effect from the 1st July 1894, or such subsequent date as he may avail himself of it.

9th July, 1894.—No. 370.—Mr. R. J. P. Pinder, Deputy Conservator of Forests, and Bhai Sadhu Singh, Extra Assistant Conservator of Forests, respectively made over and received charge of the Jhelum Forest Division on the forenoon of the 18th June 1894.

7.—CENTRAL PROVINCES GAZETTE—

10th July, 1894.—No. 3,100.—With reference to Order No. 2806, dated the 21st June 1894, Mr. H. A Hoghton, Deputy Conservator of Forests, reported his departure from Bombay on the afternoon of the 15th idem

11th July 1894.—No. 3118.—Privilege leave for three months, under Article 391 of the Civil Service Regulations, is granted to Mr. R. C. Thompson, Extra-Assistant Conservator of Forests and Working-Plans Assistant in the Saugor Forest Division, with effect from the 15th instant, or from such subsequent date as he may be permitted to avail himself of it.

11th July 1894.—No. 3120,—Privilege leave for three months, under Article 291 of the Civil Service Regulations, is granted to Mr. N. C. McLeod, Extra-Assistant Conservator of Forests, Bhandara, with effect from the 1st proximo, or from such subsequent date as he may be permitted to avail himself of it.

25th July 1894 – No. 3305,—On return from the leave on urgent private affairs for six months, granted him by Order No. 1132, dated the 6th March last, Mr. P. H Clutterbuck, Assistant Conservator of Forests, is reported to the charge of the Chhindwara Forest Division.

25th July 1804.—No. 3307.—With reference to Government of India, Revenue and Agricultural Department, Notification No. 702-*F*, dated the 11th instant, Mr. G. G. Minniken, Deputy Conservator of Forests, Punjab, assumed charge of the office of Conservator of Forests, Southern Circle, Central Provinces, from Dr. E. Dobbs, Deputy Conservator of Forests, on the forenoon of the 5th instant.

8—BURMA GAZETTE.

18th June 1894.—No. 6.—Mr. T. A. Hauxwell, Deputy Conservator of Forests, made over, and Mr. T. H. Aplin, Deputy Conservator of Forests, received, charge of the Kado division on the afternoon of the 16th June 1894.

26th June, 1894.—No. 253.—Mr. D. H. Allan, Extra-Assistant Conservator of Forests, is posted to the charge of the Pyinmana subdivision of the Pyinmana forest division, with effect from the 27th April 1894.

Revenue Department Notification No. 167 (Forests), dated the 27th April 1894, is hereby cancelled.

27th June 1894.—No. 255.—Under the provisions of Article 291 of the Civil Service Regulations, privilege leave for one month is granted to Mr. M. H. Ferrars, Deputy Conservator of Forests, with effect from the 30th June 1894, or the subsequent date on which he may avail himself of it.

27th June 1294 —No. 197.—Under the provisions of Section 12 of the Code of Criminal Procedure, 1882, the Chief Commissioner appoints Mr. T. H. Aplin, Deputy Conservator of Forests, to be a Magistrate of the 2nd Class in the Amherst, Moulmein town, and Shwegyin districts.

29th June 1894.—No 257.—The following temporary alterations of rank are ordered in the Forest Department :—

(1). With effect from the 30th May 1894, the date on which Mr. C. R. Dun, Assistant Conservator, 1st grade, availed himself of privilege leave :—

Mr. G. R. Long, Assistant Conservator, 2nd grade, to officiate as Assistant Conservator, 1st grade.

(2). With effect from the 31st May 1894, the date on which Mr. A. Weston, Officiating Deputy Conservator, 2nd grade, availed himself of privilege leave:—

Mr. J. C. Murray, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. H. Jackson, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. W. T. T. McHarg, Assistant Conservator, 1st grade, to officiate as Deputy Conservator, 4th grade.

Mr. A. M. Burn-Murdoch, Assistant Conservator, 2nd grade (on privilege leave), to officiate as Assistant Conservator, 1st grade.

(3). With effect from the 1st June 1894, the date on which Mr. W. F. L. Tottenham, officiating Deputy Conservator, 4th grade, availed himself of privilege leave:—

Mr. C. W. A. Bruce, Assistant Conservator, 1st grade, to officiate as Deputy Conservator, 4th grade.

(4). With effect from the 16th June 1894, the date on which Major C. T. Bingham, assumed charge of the Tenasserim Circle:—

Mr. F. W. Thellusson, Deputy Conservator, 2nd (officiating 1st) grade, to revert to his substantive appointment.

Mr. A. Weston Deputy Conservator, 3rd (officiating 2nd) grade (on privilege leave), to revert to his substantive appointment.

Mr. J. C. Murray, Deputy Conservator, 3rd (officiating 2nd) grade. to revert to his substantive appointment.

Mr. H. Jackson, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive appointment,

Mr. C. W. A. Bruce, Assistant Conservator, 1st grade (officiating Deputy Conservator, 4th grade), to revert to his substantive appointment.

29th June, 1894.—No 12.—With reference to Revenue Department Notification No. 228 (Forests), dated the 31st May, 1894, Mr. R. F. Lowis, Extra Assistant Conservator of Forests, assumed charge of the Magwe, subdivision, Minbu division, from Ranger Maung Po Ta on the afternoon of the 18th June, 1894.

2nd July, 1894.—No. 7.—With reference to Revenue Department Notification No. 249 (Forests), dated the 20th June, 1894, Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, made over, and Mr. J. Copeland, Deputy Conservator of Forests, received charge of the Kyaukse Forest subdivision in addition to his other duties on the afternoon of the 29th June, 1894.

4th July, 1894.—No. 8.—Mr. D. H. Allan, Extra Assistant Conservator of Forests, relinquished charge of the Pyinmana subdivision of the Pyinmana Forest division on the afternoon of the 21st June, 1894.

12th July, 1894.—No. 9.—With reference to Revenue Department Notification No 249 (Forests), dated the 20th June, 1894, Mr. W. J. Lane-Ryan, Extra Assistant Conservator of Forests, took over charge of the Pyinmana Forest subdivision on the forenoon of the 3rd instant.

19th July, 1894.—No. 268.—Mr. D. H. Allan, Extra Assistant Conservator of Forests, is transferred from Pyinmana to the charge of the Gangaw subdivision of the Yaw Forest division.

9.—ASSAM GAZETTE.

30*th June*, 1894.—No. 4543 G.—With effect from the 8th May 1894:—

Mr. H. S. K. Edie, Assistant Conservator, 2nd grade, to be Assistant Conservator, 1st grade.

Mr. A. M. Long, Assistant Conservator, 2nd grade, to be Assistant Conservator, 1st grade.

10.—HYDERABAD RESIDENCY GAZETTE.

28*th June*, 1894.—No. 233.—Mr. Ahmed Ali, an Extra Assistant Conservator of Forests of the 3rd grade, and Tahsildar of the Melghat taluk, has been granted privilege leave for three months with effect from the 22nd April 1894

28*th June* 1894.—No. 235.—Mr. B. Bhukan, Extra Assistant Conservator of Forests, is transferred from the Ellichpur to the Buldana Forest Division, and is placed in charge of the latter division

3*rd July*, 1894.—No, 250.—Mr. S. Srinivasulu Naidu, Extra Assistant Conservator of Forests and Divisional Forest Officer, Amraoti, has been granted privilege leave for two months, with effect from the 15th July 1894, or the subsequent date on which he may avail himself of it.

Mr. R. M. Williamson, Assistant Conservator of Forests, Ellichpur, is appointed to the charge of the Amraoti Forest Division during the absence of Mr. Srinivasulu Naidu on privilege leave or until further orders.

11.—MYSORE GAZETTE.

9*th July*, 1894.—No. 466—G. 93—Under Article 172 of the Mysore Service Regulations. Mr. B. Srinivasa Rao, Officiating Assistant Conservator of Forests, Shimoga, was granted casual leave of absence for eleven days from 25th April to 5th May 1894, both days inclusive.

2. Mr. C. Appaiya, Forest Probationer in charge of the Shikarpur Sub-Division, was in charge of the District Forest Office during the absence of Mr. B. Srinivasa Rao, on leave.

3*rd July*, 1894.—No. 49-G. 12.—Mr. Muttappa, Sub-Assistant Conservator of Forests, Hassan, having availed himself of twenty days' privilege leave granted to him in Notification No. 14816—8249, dated 6th March 1894, from the forenoon of the 20th May 1894, and having returned to duty on the forenoon of the 7th June 1894, the unexpired portion of the leave is hereby cancelled.

23*rd July*, 1894.—No. 1877—G. F.- 13-93.—Under Article 218 of the Mysore Service Regulations, Mr. C. E. M. Russell, Barrister-at-Law, Superintendent of Forests, Kadur District, is granted eight months' leave on medical certificate, from the 10th July, 1894.

14*th August*, 1894.—To Ranger Venkatakristnama Naidu, leave under Article 369 of the Civil Service Regulations from 9th July to 24th August, 1894, inclusive.

15*th August*, 1894.—No. 408.—Mr. E. P. Popert, Conservator of Forests, Central Circle, Madras, is granted privilege leave for three months, with effect from or after the 30th August 1894, under Article 291 of the Civil Service Regulations.

17*th August*, 1894.—No. 410.—Mr. P. M. Lushington, Deputy Conservator of Forests, Madras, has been permitted by the Right Honorable the Secretary of State for India to return to duty within the period of his leave.

18*th August*, 1894.—No. 413.—

No.	Name of officer.	Present grade.	Grade to which promotion.	Nature of promoted.	Remarks showing cause of vacancy, &c.
1	Mr. A. W. Peet ...	Conservator of Forests, 2nd grade.	Conservator of Forests, 1st grade.	Acting	During the absence of Mr. Popert on privilege leave, or until further orders.
2	Mr. J. W. Cherry ...	Conservator of Forests, 3rd grade.	Conservator of Forests, 2nd grade.	Do.	During the absence of Mr. Peet on other duty, or until further orders.
3	Mr. E. D. M. Hooper ...	Deputy Conservator of Forests, 1st grade.	Conservator of Forests. 3rd grade.	Do.	During the absence of Mr. Cherry on other duty, or until further orders.

18*th August*, 1894 —No. 414.—

No.	Name and designation of officer	District.	Nature of charge.	Remarks.
1	Mr. A. W. Peet	Central Circle	Conservator of Forests.	During the absence of Mr. Popert on privilege leave, or until further orders.
2	Mr. E. D. M. Hooper ...	Northern Circle ...	Do.	During the absence of Mr. Peet on other duty, or until further orders.
3	M. R. Ry. V. Alwar Chetty Garu, Extra Assistant Conservator of Forests, 2nd grade. ...	Bellary ...	District Forest Officer ...	During the absence of Mr. Hooper on other duty, or until further orders.

20th August, 1894.—Mr. H. E. Kelly, Ranger on Rs. 50, South Coimbatore, is granted privilege leave on medical certificate, under Article 291 of the Civil Service Regulations, for three months, from the date of relief

20th August, 7894.—The resignation of Mr. W. R. McCay, Forest Ranger, 4th grade, Ganjam District, is approved.

3.—BOMBAY GAZETTE.

30th July, 1894.—Messrs. A. Stewart and W. G. Betham, Deputy Conservators of Forests, respectively delivered over and received charge of the Divisional Forest Office, Kolaba, on the afternoon of the 20th July, 1894.

31st July, 1894.—*Erratum.*—In this Office Notification, dated 6th July, 1894, published at page 747 of the *Bombay Government Gazette*, Part I, dated 19th idem, in connection with the return to duty of Mr. K. B. Phadke, Sub-Division Forest Officer, from privilege *read* "on the forenoon" instead of "afternoon" in the last line but one.

3rd August 1894.—Mr. W. F. D. Fisher, Assistant Conservator of Forests, 2nd grade, delivered over, and Mr. A. Stewart, Deputy Convator of Forests, 3rd grade, received charge of, the Divisional Forest Office, Panch Mahals, on the 28th of July, 1894, on the forenoon.

9th August, 1894.—Mr. Haripad Mitra, Extra Assistant Conservator of Forests, Working Plans Party No. I, who was granted privilege leave of absence for three months in Government Resolution No. 5420, of the 26th July, 1894, availed himself of the same on the afternoon of 4th August 1894.

13th August, 1894.—Messrs. Vamon Ramchandra Gaunde, Extra Assistant Conservator of Forests, 1st grade, and W. F. D. Fisher, Assistant Conservator of Forests 2nd grade, respectively delivered over and received charge of Sub-Divisional Forest Office, Nasik, on the 6th instant before office hours.

14th August, 1894.—Mr. Waman Ramchandra Gaundé, Extra Assistant Conservator of Forests, 1st grade, transferred to the Northern Circle under Government Resolution No 5527, dated 28th June, 1894, reported himself for duty to the Divisional Forest Officer, West Thána on the 8th of August, 1894, in the forenoon.

2. Mr. Waman Ramchandra Gaunde has been posted to Dáhánu Sub-Division from the above date

15th August, 1894.—No. 6777.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. W. G Clabby to be Extra Assistant Conservator of Forests, 1st grade, vice Mr. Lakshman Daji Joshi, deceased, continuing to serve in the Rájpipla State. Mr. Clabby's lien on his British appointment is suspended.

Mr. W. A. Wallinger to be Extra Assistant Conservator of Forests, 1st grade, vice Mr. W. G. Clabby, seconded.

2. Subject to the provisions of paragraph 2 of Government Resolution No. 1245, dated 15th February, 1894, Messrs. Ganesh Sakharam Hinge

and B. G. Deshpande to be substantive *pro. tem.* 2nd grade Extra Assistant Conservators.

Mr. B. H. Dalal, L. C. E., to be substantive *pro tem.* 3rd grade Extra Assistant Conservator of Forests from the date of this Notification.

15*th August* 1894.—No. 6843.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. F. R. Desai to do duty as Divisional Forest Officer, Kolaba, during the absence of Mr. W. G. Betham or pending further orders.

Mr. G. A. Hight, on return from leave, to do duty as Divisiona Forest Officer, Nasik.

Mr. W. F. D. Fisher to relieve Mr. Desai at Nasik and hold charge till relieved by Mr. Hight.

18*th August*, 1894.—Mr. F. R. Desai, Deputy Conservator of Forests, and Mr. W. F. D. Fisher, Assistant Conservator of Forests respectively delivered over and received charge of the Divisional Forest Office, Nasik, on the 15th instant, after office hours.

No. 7035.—Mr. J. H. Clabby, Extra Assistant Conservator of Forests, 3rd grade, has been allowed by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

22*nd August*, 1894.—Mr. W. G. Betham, Deputy Conservator and Divisional Forest Officer, Kolaba, delivered over charge of the Kolaba Division on the afternoon of 14th August, 1894, to Mr A. C. Robinson, Extra Assistant Conservator, who handed over the same to Mr. F. R. Desai, Deputy Conservator of Forests, on the forenoon of the 17th idem.

5.—N.-W. P. AND OUDH GAZETTE.

31*st July*, 1894.—No. 2542.—Babu Karuna Nidhan Mukarji, Extra Assistant Conservator of Forests, on return from leave, to be attached to the Jaunsar Forest Division of the School Circle for the demarcation of the leased chir forests of Tehri-Garhwal.

9*th August*, 1884.—No. 2653.—The undermentioned officer has been granted by Her Majesty's Secretary of State for India extension of

Name.	Service.	Appointment.	Period and nature of leave.
Mr. E. McA. Moir ...	**Forest ...**	**Deputy Conservator of Forests.**	**Furlough of thirty four days.**

20*th August*, 1894.—No. 2772.—Mr. A. P. Grenfell, Officiating Deputy Conservator of Forests, in charge of the Saharunpore Division of the School Circle, privilege leave for three months, with effect from the 27th June, 1894.

20*th August*, 1894.—No. 2772.—The following temporary promotions and reversions among Forest Officers are notified for general nformation :—

Entry No.	With effect from—	Consequent on—	Name.	From—	To—
1	27th June, 1894 ...	Mr. A. P. Grenfell, on privilege leave.	Mr. J. C. Tulloch ...	Officiating Assistant Conservator of Forests, 1st grade.	Officiating Deputy Conservator of Forests, 4th grade.
2	25th July, 1894 ...	Colonel J. E. Campbell, on privilege leave.	Mr. E. A. Down ...	Officiating Deputy Conservator of Forests, 2nd grade.	Officiating Deputy Conservator of Forests, 1st grade.
			Mr. A. G. Hobart-Hampden.	Officiating Deputy Conservator of Forests, 3rd grade.	Officiating Deputy Conservator of Forests, 2nd grade.
			Mr. M. Hill	Officiating Deputy Conservator of Forests, 4th grade.	Officiating Deputy Conservator of Forests, 3rd grade.
			Mr. F. A. Leete ...	Officiating Assistant Conservator of Forests, 1st grade.	Officiating Deputy Conservator of Forests, 4th grade.
3	14th Agt., 1894.	Mr. M. Hill, on privilege leave.	Mr. B. B. Osmaston	Officiating Deputy Conservator of Forests, 4th grade.	Officiating Deputy Conservator of Forests, 3rd grade.

6.—PUNJAB GAZETTE.

30*th July*, 1894.—No. 398.—*Notification.*—Messrs. G. G. Minniken, Deputy Conservator of Forests, and R. J. P. Pinder, Offg. Deputy Conservator of Forests, respectively made over and received charge of the Bashahr Forest Division on the forenoon of the 26th June, 1894, consequent on the appointment of the former to officiate as Conservator of Forests in the Central Provinces.

4*th August*, 1894.—No. 400.—Mr. E. M. Coventry, Assistant Conservator of Forests, proceeded on three months' privilege leave granted him in Punjab Government Notification No. 367, dated 9th July 1894, on the afternoon of the 30th June, 1894, making over charge of the Working Plans Branch to Mr. C. P. Fisher, Officiating Deputy Conservator of Forests.

15*th August* 1894.—No. 419.—Consequent on the appointment of Mr. J. A. McKee, Deputy Conservator of Forests, 1st grade, and Officiating Conservator of Forests, to the class of Conservators,—*vide* Government of India Notification No. 443 F., dated 3rd May, 1894,—the following promotions will have effect from 23rd February, 1894 :—

Mr. G. G. Minniken, Provisional Deputy Conservator of Forests, 1st grade, to Deputy Conservator of Forests, 1st grade.

Mr. W. P. Thomas, Officiating Deputy Conservator of Forests, 1st grade, to Provisional Deputy Conservator of Forests, 1st grade.

Mr. G. F. Prevost, Provisional Deputy Conservator of Forests, 2nd grade, to Deputy Conservator of Forests, 2nd grade.

Mr. J. Ballantine, Deputy Conservotar of Forests, 3rd grade (on furlough), to Provisional Deputy Conservator of Forest 2nd grade.

Mr. J. H. Lace, Provisional Deputy Conservator of Forests, 3rd grade (on furlough), to Deputy Conservator of Forests, 3rd grade.

Mr. L. G. Smith, Officiating Deputy Conservator of Forests, 3rd grade, to Provisional Deputy Conservator of Forests, 3rd grade.

Mr. F. C. Hicks, Provisional Deputy Conservator of Forests, 4th grade, to Deputy Conservator of Forests, 4th grade.

Mr. R. J. P. Pinder, Officiating Deputy Conservator of Forests, 4th grade, to Provisional Deputy Conservator of Forests, 4th grade.

Mr. P. H. Clutterbuck, Provisional Assistant Conservator of Forests, 1st grade, to Assistant Conservator of Forests, 1st grade.

Mr A M. F. Caccia, Officiating Assistant Conservator of Forests, 1st Grade, to Provisional Assistant Conservator of Forests, 1st grade.

Punjab Government Notification No 345-A. I. 77, of 25th June 1894 is hereby cancelled.

No. 420.—Consequent on the appointment of Mr. E. Forrest, Officiating Deputy Conservator of Forests, 1st grade, to officiate in the class of Conservators,—*vide* Government of India Notification No. 448-F., of 3rd May 1894,—the following promotions will have effect from 26th February, 1894:—

Mr. L A. W. Rind, Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 1st grade.

Mr. A. M Reuther, Deputy Conservator of Forests, 3rd grade, to Officiating Deputy Conservator of Forests, 2nd grade.

Mr. H. A. Hoghton, Deputy Conservator of Forests, 4th grade, to Officiating Deputy Conservator of Forests, 3rd grade.

Mr. A. W. Blunt, Assistant Conservator of Forests, 1st grade, to Officiating Deputy Conservator of Forests, 4th grade.

Punjab Government Notification No. 346-A. L. 78, of 25th June, 1894, is hereby cancelled.

No. 421.—Consequent on the departure of Mr. L. A. W. Rind, Officiating Deputy Conservator of Forests, 1st grade, on privilege leave for two months and 27 days, the following promotions will have effect from 9th March, 1894:—

Mr. F. O. Lemarchand, Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 1st grade.

Mr. L. G. Smith, Provisional Deputy Conservator of Forests, 3rd grade, to Provisional Deputy Conservator of Forests, 3rd grade, and Officiating Deputy Conservator of Forests, 2nd grade.

Mr. H. Calthrop, Deputy Conservator of Forests, 4th grade, to Officiating Deputy Conservator of Forests, 3rd grade.

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st grade, to Provisional Assistant Conservator of Forests, 1st grade, and Officiating Deputy Conservator of Forests, 4th grade.

Punjab Government Notification No. 348-A. L. 80, of 25th June, 1894, is hereby cancelled.

No. 422.—Consequent on the departure of Mr. W. P. Thomas, Provisional Deputy Conservator of Forests, 1st grade, on furlough for one year, the following promotions will have effect from 24th March, 1894 :—

Mr. G. F. Prevost, Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 1st grade.

Mr. H. Moore, Officiating Deputy Conservator of Forests, 3rd grade, to Officiating Deputy Conservator of Forests, 2nd grade.

Mr. F. C. Hicks, Deputy Conservator of Forests, 4th grade, to Officiating Deputy Conservator of Forests, 3rd grade.

Mr. E. M. Coventry, Officiating Assistant Conservator of Forests, 1st grade, to Officiating Deputy Conservator of Forests, 4th grade.

Punjab Government Notification No. 349-A. L. 81, of 25th June, 1894, is hereby cancelled.

No 423.—Consequent on the return of Mr. C. P. Fisher, Officiating Deputy Conrervator of Forests, 4th grade, from privilege leave, the following reversion shall have effect from 12th April, 1894 :—

Mr. E. M. Coventry, Officiating Deputy Conservator of Forests, 4th grade, to Officiating Assistant Conservator of Forests, 1st grade.

Punjab Government Notification No. 352-A. L. 84.—of 25th June 1894 is hereby cancelled.

No. 424.—Consequent on the return of Mr. L. A. W. Rind, Officiating Deputy Conservator of Forests, 1st grade, from privilege leave, the following reversions shall have effect from 6th June, 1894 :—

Mr. G. F. Prevost, Officiating Deputy Conservator of Forests, 1st grade, to Deputy Conservator of Forests, 2nd grade.

Mr. H. Moore, Officiating Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 3rd grade.

Mr. F. C. Hicks, Officiating Deputy Conservator of Forests, 3rd grade, to Deputy Conservator of Forests, 4th grade.

Mr. A. M. F. Caccia, Provisional Assistant Conservator of Forests, 1st grade, and Officiating Deputy Conservator of Forests, 4th grade, to Provisional Assistant Conservator of Forests, 1st grade.

Punjab Government Notification No. 353-A. L. 85, of 25th June, 1894, is cancelled.

No. 425.—Consequent on the departure of Mr. H. A. Hoghton, Deputy Conservator of Forests, 4th grade, on furlough for one year, the following promotions shall have effect from 9th June, 1894 :—

Mr. F. C. Hicks, Deputy Conservator of Forests, 4th grade, to Officiating Deputy Conservator of Forests, 3rd grade.

Mr. A M. F. Caccia, Provisional Assistant Conservator of Forests, 1st grade, to Provisional Assistant Conservator of Forests, 1st grade, and Officiating Deputy Conservator of Forests, 4th grade.

Punjab Governtment Notification No. 351-A. L. 86, of 25th June, 1894 is cancelled.

No. 426.—Consequent on the appointment of Mr. G. G. Minniken, Deputy Conservator of Forests, 1st grade, to officiate in the class of Conservators,—*vide* Government of India Notification No. 702-F. of 11th July, 1894, the following promotions will have effect from 5th July, 1894 :—

Mr. G. F. Prevost, Deputy Conservator of Forests, 2nd grade, to Officiating Deputy Conservator of Forests, 1st grade.

Mr. H. Moore, Officiating Deputy Conservator of Forests, 3rd grade, to Officiating Deputy Conservator of Forests, 2nd grade.

Mr. R. J. P. Pinder, Provisional Deputy Conservator of Forests, 4th grade, to Provisional Deputy Conservator of Forests, 4th grade, and Officiating Deputy Conservator of Forests, 3rd grade.

Mr. E. M. Coventry, Officiating Assistant Conservator of Forests, 1st grade, to Officiating Deputy Conservator of Forests, 4th grade.

7.—CENTRAL PROVINCES GAZETTE.

31*st July*, 1894.—No. 3384.—Mr. C. K. Chatterjee, Extra Assistant Conservator of Forests, attached to the Nagpur-Wardha Forest Division, is appointed to the charge of the Bhandara Forest Division.

31*st July*, 1894.—No. 3385.—With reference to Order No 3384, dated the 31st instant, Mr. C. K. Chatterjee, Extra Assistant Conservator of Forests, was relieved of his duties in the Nagpur-Wardha Forest Division on the afternoon of the 9th instant.

31*st July* 1814.—No. 3387.—With reference to Order No. 3384, dated the 31st instant, Mr. C. K. Chatterjee, Extra Assistant Conservator of Forests, assumed charge of the Bhandara Forest Division on the forenoon of the 17th instant.

31*st July*, 1894. —No. 3388.—On being relieved by Mr. C. K. Chatterjee, Mr. N. C. McLeod, Extra Assistant Conservator of Forests, is appointed Working Plans Assistant in the Bhandara Forest Division.

9*th August*, 1894.—No. 3535.—Mr R. C. Thompson, Extra-Assistant Conservator of Forests, and Working Plans Assistant in the Saugor Forest Division, availed himself, on the afternoon of the 15th July, 1894, of the three months' privilege leave granted him by Order No. 3118, dated the 11th ultimo.

9*th August*, 1894.—No. 3539.—Privilege leave for three months, under Article 291 of the Civil Service Regulations, is granted to Mr. J. T. Hobday, Extra-Assistant Conservator of Forests, Sambalpur, with effect from the 6th instant, or the subsequent date on which he may be permitted to avail himself of it.

9*th August* 1894.—No. 3540.—Mr Narain Pershad, Forest Ranger, in charge of the Gaikhuri Range, Bhandara Forest Division, is posted temporarily to the charge of the Sambalpur Forest Division, to work under the immediate orders of the Deputy Commissioner.

21*st August* 1894 —No. 3741 —Mr. N. C. McLeod, Extra-Assistant Conservator of Forests and Working Plans Assistant, Bhandara, availed himself of the three months' privilege leave granted him by Order No. 3120, dated the 11th July, on the afternoon of the 6th instant.

8.—BURMA GAZETTE.

18*th July* 1894.—No. 10—With reference to Revenue Department No 247 (Forests), dated the 19th June, 1894, Mr. C. E. Muriel, Deputy Conservator of Forests, made over, and Mr. S. Carr, Assistant Conservator of Forests, received, charge of the Pyinmana Forest division in addition to his duties on the afternoon of the 13th July, 1894.

No 11—Mr. C. E. Muriel, Deputy Conservator of Forests, availed himself of the three months and 15 days' privilege leave granted him in Revenue Department Notification No. 246 (Forests), dated the 19th June, 1894, on the afternoon of the 13th July, 1894.

23rd July, 1893.—No. 170.—It is hereby notified, with reference to section 34 of the Forest Code, that the promotions of Messrs. Aplin, Carr, Anthony, Branthwaite and Dun, which were ordered in clause (4) of this department Notification No. 222, dated the 29th May, 1894, are substantive provisional.

25th July, 1394.—Ne. 271.—Substitute the following for second clause of this department Notification No. 253 (Forests), dated the 16th June, 1894:—

"So much of Revenue Department Notification No. 167, dated the 27th April, 1894, as refers to the posting of Mr. D. H. Allan, is cancelled."

27th July, 1894.—No. 12.—With reference to Revenue Department Notification No. 228 (Forests), dated the 31st May, 1894, Mr. R.F. Lowis, Extra Assistant Conservator of Forests, relinquished charge of the Ruby Mines subdivision, Katha Forest division, on the afternoon of the 25th May, 1894.

No. 277.—The undermentioned officer has been granted extension of leave by Her Majesty's Secretary of State:—

Mr. A M. Burn-Murdoch, Assistant Conservator of Forests, privilege leave commuted to leave on medical certificate for six months.

No. 192.—At the departmental examination held at Bassein, Akyab, Moulmein, Tavoy, Thayetmyo, Minbu, Myingyan, Mandalay, Mogok, Katha, Bhamo, Monywa, Kindat, Lashio, and Fort Stedman, on the 4th June, 1894, the following officers passed the examination in Burmese by the standards specified below:—

Higher Standard.

Mr. P. W. Healy, Extra Assistant Conservator of Forests.
Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests.

Lower Standard.

Mr. W. H. Allen, Extra Assistant Conservator of Forests.

Elementary Standard.

Mr. H. B. Anthony, Deputy Conservator of Foreste.

1st August, 1894.—No. 284.—Under the provisions of Article 282 (*a*) (*i*) of the Civil Service Regulations, privilege leave for three months and 15 days is granted to Mr. H. H. Forteath, Assistant Conservator of Forests, with effect from the 2nd August, 1894, or the subsequent date on which he may avail himself of it..

1st August, 1894 —No. 13.— Mr. H. Jackson, Deputy Conservator of Forests, relinquished charge of the Southern Shan States Division and proceeded on the three months and 15 days' privilege leave granted him in Revenue Department Notification No. 243 (Forests), dated the 16th June, 1894, on the forenoon of the 1st August, 1894.

6th August, 1894.—No. 13.—Mr. H. H. Forteath, Assistant Conservator of Forests, availed himself, with effect from the 2nd August, 1894, of the three months and 15 days' privilege leave granted him in the Revenue Department Notification No. 284 (Forests), dated the 1st August, 1894.

No. 14.—With reference to Revenue Department Notification No. 268 (Forests), dated the 19th July, 1894, Mr. D. H. Allan, Extra Assistant Conservator of Forests, assumed charge of the Gangaw subdivision, of the Yaw Forest division, on the forenoon of the 22nd July, 1894.

7th August, 1894.—No. 291.—Under the privileges of Article 291 of the Civil Service Regulations privilege leave for six weeks is granted to Mr G Q. Corbett, Deputy Conservator of Forests, with effect from the 15th August, 1894, or the subsequent date on which he may avail himself of it.

No 292.—Mr. H. N. Thompson, Assistant Conservator of Forests, is transferred from Mingin to the charge of the Toungoo Forest division.

No. 293.—Mr. C B. Smales, Assistant Conservator of Forests, is transferred from Monywa to the charge of the Mingin subdivision of the Lower Chindwin Forest Division.

13th August, 1894 —No. 15.—With reference to Revenue Department Notifications Nos. 292 and 293 (Forests), dated the 7th August, 1894, Mr. H. N. Thompson, Assistant Conservator of Forests, made over, and Mr. C. B. Smales, Assistant Conservator of Forests, received charge of the Mingin subdivision of the Lower Chindwin Forest division on the afternoon of the 8th August, 1894.

16th August, 1894 —No. 325 (Forests).—The following temporary promotions and reversions are ordered in the Forest Department :—

(1) With effect from the 2nd November 1893 :

Mr. S. Carr, Assistant Conservator, 2nd, to officiate as Assistant Conservator, 1st grade.

(2) With effect from the 20th November 1893 :

Mr. S. Carr, Assistant Conservator, 2nd, officiating 1st grade, to revert to his substantive rank.

(3) With effect from the 7th May, 1894, consequent on the grant of leave to Mr A. M. Burn-Murdoch, Assistant Conservator, 2nd grade :

Mr. S. Carr, Assistant Conservator, 2nd, to officiate as Assistant Conservator, 1st grade.

(4) With effect from the 14th July, 1894, consequent on the grant of privilege leave to Mr. C. E . Muriel, Deputy Conservator, 4th grade :

Mr. H. Jackson, Deputy Conservator, 4th, to officiate as Deputy Conservator, 3rd grade.

Mr. C. W. A. Bruce, Assistant Conservator, 1st, to officiate as Deputy Conservator, 4th grade

(5) With effect from the 1st August, 1894, consequent on the grant of privilege leave to Mr. H. Jackson, Deputy Conservator, 4th grade :

Mr. G. F. R. Blackwell, Deputy Conservator, 4th, to officiate as Deputy Conservator, 3rd grade

Mr. C. R. Assistant Conservator, 1st, to officiate as Deputy Conservator, 4th grade.

17th August, 1894.—No. 18.—With reference to Revenue Department Notification No. 292, dated the 7th August, 1894, Mr. G. Q. Corbett, Deputy Conservator of Forests, availed himself of the privilege leave granted him therein, with effect from the forenoon of the 16th August, 1894.

10.—HYDERABAD RESIDENCY GAZETTE.

20th August, 1894.—No. 302.—Mr. Mansukh Rai, Extra Assistant Conservator of Forests and Divisional Forest Officer, Wun District, has been granted privilege leave for 2 months and 8 days with effect from the 20th August, 1894, or the subsequent date on which he may avail himself of it.

Mr. V. Krishnasawmi, Forest Ranger, 3rd grade, is appointed to the charge of the Wun Division during Mr Mansukh Rai's absence on privilege leave, or until further orders.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

31st August, 1894.—No. 848-F.—Privilege leave for one month and twenty-nine days, under Articles 277 and 291 of the Civil Service Regulations, is granted to Mr. C. Bagshawe, Conservator of Forests, 1st grade, Berar, with effect from the 27th August, 1894.

Mr. H. Calthrop, Deputy Conservator, 4th (officiating 3rd) grade, Berar is appointed to hold charge of the Berar Forest Circle during Mr. Bagshawe's absence, or until further order.

2.—Madras Gazette.

25th August 1894.—Twenty days' privilege leave granted to S. Eggia Narayana Sastri, Forest Ranger, Anantapur district, in office order No. 38 of 1894-95, is hereby cancelled.

2nd September, 1894.—The transfer of Mr. S. C. Moss, Extra Assistant Conservator, to South Canara, is hereby cancelled.

6th September, 1894.—No. 434.—Mr. H. F. A. Wood, Assistant Conservator of Forests, Cuddapah, is granted examination leave for three months, with effect from or after the 25th September 1894, under para. 51 of the Forest Department Code.

10th September, 1894.—To Ranger M. Jambunada Sastri leave on medical certificate, up to 4th September 1894, in continuation of the leave notified at page 918, Part II, of the *Fort St. George Gazette*, dated 12th June, 1894.

To Ranger P. Venkatakrishnama Naidu leave for two months, from 25th August 1894, under Article 369 of the Civil Service Regulations.

17th September, 1894.—To Ranger A. P. Ramachendra Mudaliar for one month, from 8th September, 1894, under Article 291 of the Civil Service Regulations.

18th September, 1894.—M. Jambunatha Sastri, Ranger, 4th grade, is transferred from Trichinopoly to Salem District, on relief by Ranger Ramachendra Mudaliar.

19th September, 1894.—No. 463.—Mr. C. E. Brasier, District Forest Officer, Salem, is granted privilege leave for one day, in addition to two months and twenty days already granted to him in the Notification No. 193, dated 24th April 1894, published at page 499, Part I, of the *Fort St. George Gazette* of 1st May, 1894.

3.—Bombay Gazette.

19th September, 1894.—No. 7788.—Mr. G. A. Hight, Deputy Conservator of Forests, 2nd grade, has been allowed by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

25th September, 1894.—Messrs. W. F. D. Fisher, Assistant Conservator of Forests, and G. A. Hight, Deputy Conservator of Forests, respectively delivered over and received charge of the Divisional Forest Office of Nasik on the 18th instant, before office hours.

Mr. J. H. Clabby, Extra Assistant Conservator of Forests, 3rd grade, on his return from leave to Europe, reported himself for duty on the 25th instant, before office hours, and has been attached to the office of the Conservator of Forests, Central Circle, temporarily.

4.—BENGAL GAZETTE.

30th August, 1894.—No. 4454.—Mr. C. A. G. Lillingston, Deputy Conservator of Forests and Personal Assistant to the Conservator of Forests, Bengal, held charge of the Tista Forest Division from the afternoon of the 4th to the forenoon of the 18th August 1894, in addition to his own duties.

Mr. F. Trafford, Assistant Conservator of Forests, is appointed to hold charge of the Tista Forest Division from the date of his relieving Mr. C. A. G. Lillingston and during the absence, on leave, of Mr. H. D. D. French, or until further orders.

15th September, 1894.—No. 4639.—Mr. E. P. Stebbing, Assistant Conservator of Forests, attached to the Singhbhum Forest Division, is granted two months' examination leave, under Section 69 of the Forest Department Code, with effect from the 8th September 1894, or from any subsequent date on which he may avail himself of it.

5.—N.-W. P. AND OUDH GAZETTE.

18th September, 1894.—No. 3036.—The undermentioned officers has been granted by Her Majesty's Secretary of State for India permission to return to duty :—

Name.	Service.	Appointment.	Date on which permitted to return.
Mr. N. Hearle ...	Forest	Deputy Conservator of Forests.	Within period of leave.

18th September, 1894.—No. 3035.—The undermentioned officers has been granted by Her Majesty's Secretary of State for India extension of leave :—

Name.	Service.	Appointment.	Period and nature of leave.
Mr. N. Hearle ...	Forest	Deputy Conservator of Forests.	One week's furlough.

22nd September, 1894.—No. 3070.—Mr. L. Mercer, Deputy Conservator of Forests, on return from furlough, to the charge of the Gonda Forest Division of the Oudh Circle.

22nd September, 1894.—No. 3071.—Lala Har Swarup, Extra Assisant Conservator of Forests, in charge of the Gonda Forest Division of the Oudh Circle, on being relieved by Mr. L. Mercer, is placed on special duty in the Kheri and Bahraich Forest Divisions of the same circle.

22nd September, 1894.—No. 3128.—The undermentioned officer has been granted by Her Majesty's Secretary of State for India permission to return to duty :—

Name.	Service.	Appointment.	Date on which permitted to return.
Mr. L. Mercer ...	Forest	Deputy Conservator of Forests.	Within period of leave.

28th September, 1894.—No. 3132.—Mr. A. P. Grenfell, Officiating Deputy Conservator of Forests, on return from leave, to the charge of the Dehra Dun Forest Division of the School Circle.

28th September, 1894.—No. 3133.—Mr. H. G. Billson, Assistant Conservator of Forests, in charge of the Dehra Dun Forest Division of the School Circle, on being relieved by Mr. A. P. Grenfell, to be attached to that Division

6.—PUNJAB GAZETTE.

31st August, 1894.—No. 440.—Consequent on the return of Mr. P. H. Clutterbnck, Assistant Conservator of Forests, 1st grade, from special leave, the following changes will have effect from the 15th August 1894 :—

Mr. P.H. Clutterbuck, Assistant Conservator of Forests, 1st grade, to officiate as Deputy Conservator of Forests, 4th grade.

Mr E. M. Coventry, Officiating Deputy Conservator of Forests, 4th grade (on privilege leave), to Officiating Assistant Conservator of Forests, 1st grade.

22nd September, 1894.—No. 475.—Mr. A. L. McIntire, Deputy Conservator of Forests, Punjab, is granted furlough for seventeen months, under Article 340 (*b*) of the Civil Service Regulations, with effect from the 15th May, 1895, or such subsequent date as he may avail himself of it.

7.—CENTRAL PROVINCES GAZETTE.

29th August, 1894 —No. 1883.—Mr. J. J. Hobday, Extra-Assistant Conservator of Forests, Sambalpur, availed himself, on the afternoon of the 18th instant, of the three months' privilege leave granted him by Order No. 3539, dated the 9th instant, making over charge of his duties to the Deputy Commissioner of Sambalpur.

31st August, 1894.—No. 3935.—Mr. P. H. Clutterbuck, Assistant Conservator of Forests, reported his arrival in Bombay on the forenoon of the 15th idem, on return from the leave granted him by Order No. 1182, dated the 6th March last.

The unexpired portion of his leave is hereby cancelled.

4th September, 1894.—No. 3982.—With reference to Order No. 3305, dated the 25th July 1894, Mr. P. H. Clutterbuck, Assistant Conservator of Forests, assumed charge of the Chhindwara Forest Division from Mr. W. G. Gilmore, Forest Ranger, on the forenoon of the 21st August.

12th September, 1894.—No. 4070.—Privilege leave for one month, under Article 291 of the Civil Service Regulations, is granted to Mr. H. Moore, Deputy Conservator of Forests, Betul, with effect from the 1st instant, or the subsequent date on which he may avail himself of it

12th September, 1894.—No. 5071.—Mr. S. G. Paranjpe, Extra-Assistant Conservator of Forests and Working-Plans Assistant, Mandla, is posted to the charge of the Betul Forest Division, during the absence of Mr. Moore on privilege leave or until further orders.

8.—BURMA GAZETTE.

27th August, 1894.—No. 329.—Mr. F. Ryan, Extra Assistant Conservator of Forests, 4th grade, on probation, is confirmed in his appointment, with effect from the 4th June, 1894.

27th August, 1894.—No. 330.—In exercise of the power conferred by Section 2 of the Upper Burma Forest Regulation, 1817, and Section 3 of the Burma Forest Act 1881, the Chief Commissioner appoints the following Extra Assistant Conservators of Forests to discharge the functions of a Forest Officer and to exercise all the powers conferred on Sub-Assistant Conservators by the rules hitherto made under the enactments in question :—

Mr. C. S. Rogers.	Mr. D. H. Allan.

27th August, 1894.—No. 331.—Mr. C. S. Rogers, Extra Assistant Conservator of Forests, Ruby Mines subdivision, is posted to the charge of the Mongmit subdivision, Katha Forest division, in addition to his other duties, with effect from the 10th July, 1894.

5th September, 1894.—No. 339.—Under the provisions of Article 291 of the Civil Service Regulations, privilege leave for one month is granted to Mr. C. W. Allan, Extra Assistant Conservator of Forests, with effect from the 15th September 1894, or the subsequent date on which he may avail himself of it.

6th September, 1894.—No. 345.—The following postings are ordered :—

Mr. C. Ingram, Extra Assistant Conservator of Forests, on his return from leave, to the charge of the Shwegyin Forest Division, Mr. J. Messer, Assistant Conservator of Forests, from the Shwegyin Division to Rangoon, as Personal Assistant to Conservator, Pegu Forest Circle.

4th September, 1394.—No. 337.—The following postings are ordered :—

Mr. A. Weston, Deputy Conservator of Forests, on the his return from leave, to the charge of the Kado Forest division.

Mr. T. H. Aplin, Deputy Conservator of Forests, from Moulmein to the charge of the Lower Chindwin Forest division.

10th September, 1884.—No. 7.—Mr. T. H. Aplin, Deputy Conservator of Forests, made over, and Mr. A. Weston, Deputy Conservator of Forests, received charge of, the Kado division on the afternoon of the 8th September 1894.

10th September, 1894.—No. 346.—On being relieved by Mr. W.F.L. Tottenham, Mr. H. Carter, officiating Deputy Conservator of Forests is transferred from Pegu to the charge of the Working Plans division.

11th September, 1894.—No. 348.—The Chief Commissioner directs that the Western Forest division shall be divided into two divisions, to be called respectively the Henzada-Thongwa Forest division, with headquarters at Henzada, and the Bassein-Myaungmya Forest division, with headquarters at Bassein.

The local limits of the Henzada-Thongwa Forest division shall be those of the Henzada and Thongwa districts. The local limits of the Bassein-Myaungmya Forest division shall be those of the Bassein and Myaungmya districts.

No. 349.—Mr. H. B. Anthony, Deputy Conservator of Forests, is posted to the charge of the Henzada-Thongwa Forest Division.

No. 350.—Mr. H. B. Ward, Deputy Conservator of Forests, is posted to the charge of the Bassein-Myaungmya Forest Division.

No. 352.—Under the provisions of Article 291 of the Civil Service Regulations, privilege leave for two months and 15 days is granted to Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, with effect from the date on which he may avail himself of it.

13th September, 1894—No. 41.—With reference to Revenue Department Notification No. 346, dated the 10th September 1894, Mr. H Carter, Deputy Conservator of Forests, resumed charge of the Working Plans Division on the forenoon of the 11th September 1894.

14th September, 1894—No. 358.—The following postings and transfers are ordered in the Forest Department :—

Mr. G. Q. Corbett, Deputy Conservator of Forests, on return from leave, to the charge of the Toungoo Forest division.

Mr. H. N. Thompson, Assistant Conservator, of Forests, from Toungoo to the charge of the Mingin subdivision of the Lower Chindwin Forest division

Mr. C. B. Smales, Assistant Conservator of Forests, from Mingin to the charge of the Magwe subdivision of the Minbu Forest division.

Mr. R. F. Lowis, Assistant Conservator of Forests, from Taungdwingyi to the Yaw Forest division.

17th September, 1894.—No. 359 —Under the provisions of Section 69 of the Forest Department Code, examination leave for 28 days is granted to Mr. W. A Hearsey, Extra Assistant Conservator of Forests, with effect from the 8th October 1894.

17th September, 1894.—No. 14.—Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, relinquished charge of the Myadaung subdivision of the Katha Forest division, and availed himself of the two months and 15 days' privilege leave granted him in Revenue Department Notification No. 352, dated the 11th September 1894, on the forenoon of the 8th idem.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

28th September, 1894.—No. 972-F.—Privilege leave for one month and twenty-nine days, under Articles 277 and 291 of the Civil Service Regulations, is granted to Mr. C. Bagshawe, Conservator of Forests, 1st grade, Berar, with effect from the 27th August, 1894.

Mr H. Calthrop, Deputy Conservator, 4th (officiating 3rd) grade Berar, is appointed to officiate in the 3rd grade of Conservators, and to hold charge of the Berar Forest Circle during Mr. Bagshawe's absence, or until further orders.

The Notification of this Department No. 848-F., dated the 30th ultimo, is hereby cancelled.

19th October, 1894.—No. 1045-F.—Mr. F. B. Dickinson, Deputy Conservator, 1st grade, Central Provinces, and officiating Conservator 3rd grade, Burma, is confirmed in the latter grade, with effect from 10th April, 1894.

No. 1048-F.—Mr. E. P. Dansey, Conservator of Forests, 2nd grade, is, on return from furlough, posted to the Punjab in charge of the provincial Forest Circle.

2.—MADRAS GAZETTE.

19th September, 1894.—R. Venkatesa Mudaliar, Forest Ranger, is transferred from Kurnool to Godavari, *vice* A. Eggia Sastri, deceased.

23rd September, 1894.—Mr. E. C. M. Mascurenhas, Ranger on Rs. 50, North Coimbatore, is granted privilege leave (on medical grounds) for one month, under Article 291 of the Civil Service Regulations, from 3rd September, 1894

11th October, 1894.—Mr. E. C. M. Mascurenhas, Ranger on Rs. 50, North Coimbatore, is granted an extension of ten days' leave in continuation of the one month's privilege leave (on medical certificate) published on page 1486 of Part II of the *Fort St. George Gazette*, dated 2nd October, 1894.

12th October, 1894.—No. 486.—Mr S. C. Moss, Extra Assistant Conservator of Forests, is granted privilege leave for three months, under Article 291 of the Civil Service Regulations.

19th October, 1894.—No. 499.—Mr. Stephen Cox, Assistant Conservator of Forests, Kurnool, is granted examination leave not exceeding three months, under paragraph 51 of the Madras Forest Department Code.

No. 500.—Mr. F Foulkes, District Forest Officer, South Canara, is granted privilege leave for three days, in extension of the two months' privilege leave notified at page 857 of Part I of the *Fort St. George Gazette*, dated 17th July, 1894.

22nd October, 1894.—No. 501.—Mr. Rhodes Morgan, Acting District Forest Officer, South Canara, is granted furlough for two years, under Article 340 (*b*) of the Civil Service Regulations.

22nd October, 1894 —No. 504 :—

No	Name of officer.	District.	Nature of charge.	Remarks.
1	Mr. H. B. Bryant, Deputy Conservator of Forests, 4th grade.	Tinnevelly	District Forest Officer.	To join on relief by Mr. Cowley-Brown.
2	Mr. F. C. L. Cowley-Brown, Assistant Conservator of Forests, 1st grade.	South Coimbatore.	Acting District Forest Officers.	To join forthwith.

23rd October, 1894.—G. Arulanantham Pillai, Ranger on Rs. 50, Nilgiri District, is granted leave without allowances, under Article 372 of the Civil Service Regulations, for fifteen days from the date of relief.

23rd October, 1894. —The three months' privilege leave on medical certificate published in page 1326 of Part II of the *Fort St. George Gazette*, dated 28th August, 1894, to Mr. H. E. Kelly, Ranger on Rs. 50, South Coimbatore Division, is commuted into sick leave, and the same is extended by one month.

24th October, 1894 —Mr. E. C. M. Mascurenhas, Ranger on Rs. 50, North Coimbatore, is granted a further extension of two weeks' leave, in continuation of ten days' leave published in page 1570 of Part II of the *Fort St. George Gazette*, dated 16th October, 1894.

3.—BOMBAY GAZETTE.

24th September, 1894.—Mr. Haripad Mitra, Extra Assistant Conservator of Forests, who proceeded on privilege leave on the afternoon of 4th August, 1894, resumed charge of duties on the 18th September, 1894, before office hours.

3rd October. 1894.—No. 8165 —His Excellency the Governor in Council is pleased to place the services of Mr. J. H Clabby, Extra Assistant Conservator of Forests, 3rd grade, at the disposal of the Government of India for employment as Forest Officer to the Barwani State.

10th October, 1894 —No. 8290.—His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. W. G. Betham, on return to duty, to resume charge of the Divisional Forest Office Kolaba

Mr. F. R. Desai, on relief, to do duty as Divisional Forest Officer, West Thana, vice Mr. G. P. Millett

10th October, 1894.—No 8311 —Mr. W. G. Betham, Deputy Conservator of Forests, 2nd grade and Divisional Forest Officer, Kolaba, is allowed leave on medical certificate for two months under Article 369 of the Civil Service Regulations.

12th October, 1894.—No. 8373.—His Excellency the Governor in Council is pleased to appoint Mr. F. R. Desai to be Deputy Conservator of Forests, of Sind Circle, in place of Mr. W. S. Hexton, deceased.

19th October, 1894.—Mr J. H. Clabby, Extra Assistant Conservator of Forests, relinquished charge of his duties on the afternoon of the 17th instant, and proceeded to join his appointment to the Burwani State.

23rd October, 1894 —No. 8697.—His Excellency the Governor in Council is pleased to make the following transfers :—

Mr. C. M. Hodgson to be Divisional Forest Officer, West Thana.

Mr. W. F. D. Fisher to be Divisional Forest Officer, Sholapur.

23rd October, 1894.—No. 8698.—The undermentioned officers passed an examination in Marathi according to the Lower Standard on the 11th October, 1894 :—

1. Mr Dattatraya M. Bijur, Personal Assistant to the Conservator of Forests, S. C.

2. { Mr. V. P. Ribeiro, Extra Assistant Conservator of Forests, Bassein, Thana.
   { Mr. J. H. Clabby, Extra Assistant Conservator of Forests, 3rd grade.

4. Mr. G. R. Duxbury, Assistant Conservator of Forests, Poona.

The names are arranged in the order of merit.

23rd October, 1894.—No. 8699.—The undermentioned officers passed an examination in Marathi according to the Higher Standard on the 10th October, 1894 :—

1. Mr. V. P. Ribeiro, Extra Assistant Conservator of Forests, Bassein. Thana

2. { Mr Dattatraya H. Bijur, Personal Assistant to the Conservator of Forests, S. C.
   { Mr. A. C Robinson, Sub-Divisional Forest Officer, Kolaba

4. Mr J H. Clabby, Extra Assistant Conservator of Forests, 3rd grade.

The names are arranged in the order of merit.

23rd October, 1894.—Messrs. H W. Keys, Deputy Conservator of Forests, Divisional Forest Officer of West Khandesh, and R. H. Madan, Divisional Forest Officer of East Khandesh, respectively delivered over and received charge of the West Khandesh Division on the 16th October, 1894, in the afternoon.

23rd October, 1894,—Messrs. F. R. Dasai and W. G. Betham, Deputy Conservators, respectively delivered over and received charge of the Divisional Forest Office, Kolaba, on the forenoon of 16th day of October, 1894.

5—N.-W. P. AND OUDH GAZETTE.

***3rd October*, 1894.—No. 3206.—Babu Raghu Nath Pathak,** Extra Assistant Conservator of Forests, in charge of the Garhwal Forest Division of the Central Circle, to hold charge of the Kumaun Forest Division of the same circle, in addition to his own duties, until relieved by Mr. W. Shakespear.

***3rd October*, 1894.—No. 3207.—Mr. A. G. Hobart-Hampden,** Deputy Conservator of Forests, on being relieved by Babu Raghu Nath Pathak, from the charge of the Kumaun to that of the Ganges Forest Division of the Central Circle.

***3rd October*, 1894.—No. 3208.—Mr. W. Shakespear,** Deputy Conservator of Forests, on being relieved by Mr. A. G. Hobart-Hampden, from the charge of the Ganges to that of the Kumaun Forest Division of the Central Circle.

***5th October*, 1894.—No. 3267.—Mr. H. G. Billson,** Assistant Conservator of Forests, attached to the Dehra Dun Forest Division of the School Circle, to the charge of the Kheri Forest Division of the Oudh Circle.

6.—PUNJAB GAZETTE.

The 26th October, 1894.—No. 514.—Mr. E. M. Coventry, Assistant Conservator of Forests, returned from three months' privilege leave sanctioned in Punjab Government Notification No. 367, dated 9th July, 1894, on the forenoon of the 3rd October, 1894.

7.—CENTRAL PROVINCES GAZETTE.

25th September, 1894.—No. 4265.—With reference to order No. 3540, dated the 9th ultimo, Mr. Narain Pershad, Forest Ranger, assumed charge of the Sambalpur Forest Division on the forenoon of the 11th instant.

28th September, 1894.—No. 4320.—Mr. H. Moore, Deputy Conservator of Forests, Betul, availed himself, on the afternoon of the 1st instant, of the one month's privilege leave granted him by Order No. 4070, dated the 12th instant, making over charge of his duties to Mr. S. G. Paranjpe, Extra-Assistant Conservator of Forests.

4th October, 1894.—No. 4357.—Mr. P. H. Clutterbuck, Assistant Conservator of Forests and Forest Divisional Officer, Chhindwara Forest Division, is appointed a Working-Plans Officer, and deputed to the Chanda Forest Division.

4th October, 1894—No. 4358—Mr. W. G. Gilmore, Forest Ranger, in the Chanda Forest Division, is posted temporarily to the charge of the Chhindwara Forest Division, to work under the immediate orders of the Deputy Commissioner, during the absence of Mr. Clutterbuck on deputation, or until further orders.

4th October, 1894.—No. 4361.—Mr. F. S. Barker, Deputy Conservator of Forests, has been granted, by Her Majesty's Secretary of State for India, three months' extraordinary leave granted him by Order No. 435, dated the 20th January last.

4th October, 1894.—No 4362.—Mr F. S. Barker, Deputy Conservator of Forests, has been permitted, by Her Majesty's Secretary of State for India, to return to duty within the period of the leave granted him by the following Notifications and Orders:—

Notification No. 47, dated the 4th January, 1893.
Notification No. 970, dated the 20th February, 1893.
Notification No. 3558, dated the 2nd August, 1893.
Order No. 435, dated the 20th January, 1894.
Order No. 4361, dated the 4th October, 1894.

24th October, 1894.—No. 4676.—Mr. C. O. Hanson, Assistant Conservator of Forests and Working-Plans Assistant in the Nagpur-Wardha Forest Division, is transferred to the Chanda Forest Division in the same capacity.

8.—BURMA GAZETTE.

24th September, 1894.—No. 16.—With reference to Revenue Department Notification No. 346, dated the 10th September, 1894, Mr. H. Carter, officiating Deputy Conservator of Forests, made over, and Mr. W. F. L. Tottenham, officiating Deputy Conservator of Forests, resumed charge of the Pegu division on the forenoon of the 11th instant.

24th September, 1894.—No. 17.—With reference to Revenue Department Notification No. 345, dated the 6th September, 1894, Mr. J. Messer, Assistant Conservator of Forests, made over, and Mr. C. Ingram, Extra Assistant Conservator of Forests, assumed charge of the Shwegyin division on the forenoon of the 18th instant.

24th September, 1894.—No. 18.—With reference to Revenue Department Notification No. 345, dated the 6th September, 1894, Mr. J. Messer, Assistant Conservator of Forests, assumed charge of his duties as Personal Assistant to the Conservator of Forests, Pegu Circle, on the forenoon of the 14th instant.

24th September, 1894.—No. 16.—With reference to Revenue Department Notifications Nos. 337 and 349, dated the 4th and 11th September, 1894, respectively, Mr. H. B. Anthony, Deputy Conservator of Forests, made over, and Mr. T. H. Aplin, Deputy Conservator of Forests, received charge of, the Lower Chindwin Forest division on the afternoon of the 21st September, 1894.

24th September, 1894.—No. 370.—Mr. C. S. Rogers, Extra Assistant Conservator of Forests, is appointed to the charge of the Myadaung subdivision, in addition to his other duties, during the absence on privilege leave of Mr. R. M. Kavanagh, Extra Assistant Conservator of Forests, or until further orders.

29th September, 1894.—No. 19.—With reference to Revenue Department Notification No. 358, dated the 14th September, 1894, Mr. H. N. Thompson, Assistant Conservator of Forests, made over, and Mr. G. Q. Corbett, Deputy Conservator of Forests, resumed charge of the Toungoo division on the afternoon of the 25th instant.

2nd October 1894.—No. 381 (CORRIGENDUM).—In this department Notification No. 345, dated the 6th September, 1894.

for—

Mr. C. Ingram, Extra Assistant Conservator of Forests, on his return from leave, * * *

Read—

Mr. C. Ingram, Extra Assistant Conservator of Forests, on his return from the Andamans, * * *

3rd October, 1894.—No. 16.—With reference to Revenue Department Notification No. 370 (Forests), dated the 24th September, 1894, Mr. C. S. Rogers, Extra Assistant Conservator of Forests, took charge of Myadaung subdivision of the Katha Forest division on the forenoon of the 14th September, 1894, in addition to his other duties.

4th October, 1894.—No. 17.—Mr. C. R. Dun, officiating Deputy Conservator of Forests, returned from privilege leave granted him in Revenue Department Notification No. 183 (Forests), dated the 9th May, 1894, on the afternoon of the 15th September, 1894.

4th October, 1894.—No. 18.—With reference to Revenue Department Notification No. 334 (Forests), dated the 31st August, 1894, Mr. E. A. O'Bryen, officiating Deputy Conservator of Forests, made over, and Mr. C. R. Dun, officiating Deputy Conservator of Forests, assumed charge of the Ruby Mines Forest division on the forenoon of the 28th September, 1894.

No. 17.—Mr. C. W. Allan, Extra Assistant Conservator of Forests, made over charge of the Paungbyin subdivision, Upper Chindwin division, to Mr J. W. Anthony, Forest Ranger, on the forenoon of the 24th September, 1894, and availed himself from that date of the one month's privilege leave granted him in Revenue Department Notification No. 339 (Forests), dated the 5th September, 1894.

11*th October*, 1894. No. 388.—Mr C. W. B. Anderson, Extra Assistant Conservator of Forests, under suspension, is permitted to return to duty, and is posted to the charge of the Kyauksé subdivision of the Mandalay Forest division.

No. 19 (CORRIGENDUM).—In this Department Notification No. 17, dated the 4th October, 1894, Part IV of the *Burma Gazette*, dated the 18th October, 1894, *for* "on the afternoon of the 15th September, 1894," *read* "on the forenoon of the 18th September, 1894 "

18*th October*, 1894. No. 18.—With reference to Revenue Department Notification No 358, dated the 14th September, 1894, Mr. C B. Smales, Assistant Conservator of Forests, made over, and Mr. H. N. Thompson, Assistant Conservator of Forests, received, charge of the Mingin subdivision, Lower Chindwin division, on the forenoon of the 8th October, 1894.

19*th October*, 1894. No. 390.. The following temporary promotions and reversions are ordered in the Forest Department :—

(1) With effect from the 1st August, 1894 :

Mr. H. N. Thompson, Assistant Conservator, 2nd (officiating 1st) grade, to officiate as Deputy Conservator, 4th grade.

(2) With effect from the 16th August, 1894, consequent on the grant of privilege leave to Mr. G. Q. Corbett, Deputy Conservator, 4th grade :

Mr. C L. Toussaint, Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

Mr. J. Messer, Assistant Conservator, 2nd grade, to officiate as Deputy Conservator, 4th grade.

(3) With effect from the 9th September, 1894, consequent on the return from privilege leave of Mr. A. Weston, Deputy Conservator, 3rd grade :

Mr C. L. Toussaint, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive rank.

Mr. J. Messer, Assistant Conservator, 2nd grade, officiating Deputy Conservator, 4th grade, to officiate as Assistant Conservator, 1st grade.

(4) With effect from the 11th September, 1894, consequent on the return from privilege leave of Mr. W. F. L. Tottenham, Assistant Conservator, 1st grade :

Mr. C. R. Dun, Assistant Conservator, 1st grade, officiating Deputy Conservator, 4th grade, to revert to his substantive rank.

Mr. H. N. Thompson, Assistant Conservator, 2nd grade, officiating Deputy Conservator, 4th grade, to officiate as Assistant Conservator, 1st grade.

(5) With effect from the 26th September, 1894, consequent on the return from privilege leave of Mr. G. Q. Corbett, Deputy Conservator, 4th (officiating 3rd) grade :

Mr. H. Jackson, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive rank.

Mr. G. F. R. Blackwell, Deputy Conservator, 4th (officiating 3rd) grade, to revert to his substantive rank.

Mr. C. W. A. Bruce, Assistant Conservator, 1st grade, officiating Deputy Conservator, 4th grade, to revert to his substantive rank.

4th October, 1894.—No. 391.—The following postings and transfers are ordered in the Forest Department:—

Mr. C. W. Allan, Extra Assistant Conservator of Forests, on return from leave, to the charge of the Paungbyin subdivision, Upper Chindwin Forest division.

Mr. H. H. Forteath, Assistant Conservator of Forests, on return from leave, to the charge of the Gangaw sub-division, Yaw Forest division.

Mr. A. M. Burn-Murdoch, Assistant Conservator of Forests, on return from leave, to the charge of the Paungbyin subdivision, Upper Chindwin Forest division.

Mr. D. H. Allans, Extra Assistant Conservator of Forests, on being relieved by Mr. Forteath, to the Yaw Forest division.

Mr. C. W. Allan, Extra Assistant Conservator of Forests, on being relieved by Mr. Burn-Murdoch, the charge of the Kindat Revenue subdivision Upper Chindwin Forest division.

19th October, 1894.—No. 20.—Mr. W. A. Hearsey, Extra Assistant Conservator of Forests, availed himself of the 28 days' examination leave granted him in Revenue Department Notification No. 359, dated the 17th September, 1894, on the afternoon of the 8th October, 1894.

No. 21.—Mr. W. A. Hearsey, Extra Assistant Conservator of Forests, made over, and Mr. E. A. Carr, Deputy Conservator of Forests, Bhamo division, received, charge of the Shwegu subdivision, in addition to his other duties, on the afternoon of the 8th October, 1894.

23rd October, 1894.—No. 20.—With reference to Revenue Department Notification No. 348 (Forests), dated the 11th September, 1894, Mr. H. B. Ward, Deputy Conservator of Forests, made over, and Mr. H. B. Anthony, Deputy Conservator of Forests, received, charge of the Henzada-Thôngwa division on the forenoon of the 12th October, 1894.

24th October, 1894.—No. 21.—With reference to Revenue Department Notification No. 350 (Forests), dated the 11th September, 1894, Mr. H. B Ward, Deputy Conservator of Forests, assumed charge of the Bassein-Myaungmya division on the forenoon of the 12th October, 1894.

11.—MYSORE GAZETTE.

26th September, 1894.—No. 5807.—Mr. S. A. Bapu Rao, Assistant Conservator of Forests, was employed on General Duty in the office of the Inspector-General of Forests from the 8th August, 1893, to 23rd February, 1894.

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—Gazette of India.

8th November, 1894,—No, 1135-F.—Privilege-leave for one month and twenty-one days, under Articles 277 and 291 of the Civil Service Regulations, is granted to Mr. H. C. Hill, Conservator of Forests, 1st grade, Central Circle, North-Western Provinces and Oudh, with effect from 21st October, 1894.

Colonel J. E. Campbell, I. S. C. Deputy Conservator, 1st grade, North-Western Provinces and Oudh, is appointed to officiate in the 3rd grade of Conservators and to hold charge of the Central Forest Circle, with effect from 24th October, 1894, and until further orders.

8th November 1894.—No. 1137-F.—Consequent on the return of Mr C. Bagshawe, Conservator of Forests, Berar, from the privilege leave granted him in the Notification of this Department No. 972-F., dated the 28th September, 1894, Mr. H. Calthrop, Officiating Conservator, reverted to his substantive appointment of Deputy Conservator in Berar, with effect from 25th October, 1894.

16th November, 1894,—No. 1186-F.—With reference to the Notification of this Department, No. 1048-F., dated the 19th ultimo, Mr. Dansey assumed charge of the Punjab Forest Circle on the 10th November, 1894.

From the same date, Mr. Dansey will officiate in the 1st grade of Conservators during the absence of Mr. H. C. Hill on privilege leave, or until further orders ; and Mr. C. F. Elliott, Officiating Conservator, 3rd grade, Punjab, reverted to his substantive appointment of Deputy Conservator, 1st grade, and is re-transferred to Baluchistan.

Mr. A M. Reuther, Deputy Conservator, Baluchistan, on relief by Mr. Elliott, is posted to the Punjab.

2.—Madras Gazette.

10th November, 1894.—The Board of Revenue has granted privilege leave for ten days, under article 291 of the Civil Service Regulations, to Mr. H. Tireman, Assistant Conservator of Forests, South Canara District.

20th November, 1894.—No 539.—Mr. E. A. Eber-Hardie, Extra Assistant Consevator of Forests, Madras, has been permitted by the Right Honorable the Secretary of State to return to India within the period of his sick leave and to spend the remainder of his leave in India.

14th November, 1894.—S. Arokiaswami Pillai, Forest Ranger, 5th Grade, Vizagapatam District, is granted leave on half pay for three months from date of relief.

3.—Bombay Gazette.

3rd November, 1894.—No. 9002.—His Excellency the Governor in Council is pleased to appoint Mr. G. M. Ryan to act as Deputy Conservator of Forests, Sind Circle, in addition to his own duties, from 11th October 1894 till the date of his relief by Mr. F. R. Desai.

7th November, 1894,—No. 9288.—His Excellency the Governor in Council is pleased to appoint Mr. G. R. Duxbury, Assistant Conservator of Forests, Second Grade, to do duty at Násik.

9th November, 1894.—Messrs. C. M. Hodgson, Assistant Conservator of Forests and Divisional Forest Officer, Sholápur, and W. F. D. Fisher, Assistant Conservator, respectively delivered over and received charge of the Sholápur Division, on the 5th November 1894, in the afternoon.

Messrs. W. F. D. Fisher, Assistant Conservator, and G. A. Hight, Deputy Conservator, respectively delivered over and received charge of the Sub-division Office, Násik, on the 27th October 1894, in the afternoon.

15th November, 1894.—Mr. G. P. Millett, Deputy Conservator of Forests, Fouth Grade delivered over and Mr. C. M. Hodgson, Assistant Conservator of Forests, First Grade, received charge of the Divisonal Forest Office, West Thána, in the afternoon of 10th November 1894.

20th November, 1894,—No. 9513.—The undermentioned officers passed on the 11th October 1894 the examination in Law prescribed in Rule 4 at the rules published in Government Notification No, 2, dated 3rd January 1894, for the examination of officers of the Forest Department.

Passed with Credit.

(1) Mr. A. N. Master, Sháhápur, Sub-division Forest Officer, East Thána.

(2) Mr V. P. Robeiro, Extra-Assistant Conservator of Forests, Bassein, Thána.

Passed.

(3) Mr. V. M. Tilak, acting Extra-Assistant Conservator of Forests, Fourth Grade, Poona.

(4) Mr. K. B. Phadke, Kalyán Sub-division Forest Officer, East Thàna.

(5) Mr. A. C. Robinson, Sub-divisional Forest Officer, Kolába.

(6) Mr. Dattatraya M. Bijur, Personal Assistant to the Conservator of Forests S. C.

(7) Mr. J. H. Clabby, Extra-Assistant Conservator of Forests, Third Grade.

(8) Mr. N. D. Sátáraväla, Extra-Assistant Conservator of Forests, Working Plans Party II, S. C. Kárwár.

The names are arranged in the order of merit.

22nd November, 1894.—Mr. David A. Thomson, Assistant Conservator of Forests, reported his arrival at Sátráa on the 2nd November 1894, after office hours, in accordance with Government Resolution, No. 8292, dated 10th October 1894, in the Revenue Department.

4.—BENGAL GAZETTE.

1st November 1894.—No. 4308F.—Babu Kedar Nath Mozumdar, Extra Assistant Conservator of Forests, Angul Forest Division, is granted privilege leave for three months, under article 299 of the Civil Service Regulations, from the date on which he may be relieved.

Babu Gurudas Chatterji, Ranger, in charge of the Palamau Forest Division, is posted, on being relieved by Mr. F. Trafford, Assistant Conservator of Forests, to the Angul Forest Division, to be in charge of it during the absence of Babu Kedar Nath Mozumdar on leave, or until further orders.

Mr. E. Trafford, Assistant Conservator of Forests, Tista Forest Division, is posted to the Palamau Forest Division, on being relieved by Mr. H. D. D. French, Deputy Conservator of Forests, on return from privilege leave.

5—N.-W. P. AND OUDH GAZETTE.

8th November, No.—3649.—Mr. H. G. Billson, Assistant Conservator of Forests, in charge of the Kheri Forest Division of the Oudh Circle, on being relieved by Mr. M. Hill, to be attached to that Division.

22nd November, 1894.—No. 3847.—The undermentioned officer has been granted by Her Majesty's Secretary of State for India permission to return to duty :—

Name.	Service.	Appointment.	Date on which permitted to return.
Mr. E. McA. Moir ...	Forest Department.	Deputy Conservator of Forests.	Within period of leave.

27th November, 1894.—The following temporary promotions and reversions in the Forest Department are notified for general information :—

Entry No.	With effect from—	Consequent on—	Name.	From—	To—
1	20th October 1894.	Mr. L. Mercer's return from furlough.	Mr. L. Mercer	Deputy Conservator, 4th grade.	Officiating Deputy Conservator, 3rd grade.
			„ M. Hill (on privilege leave).	Officiating Deputy Conservator, 3rd grade.	Officiating Deputy Conservator, 4th grade.
			„ B. B. Osmaston.	Officiating Deputy Conservator, 3rd grade.	Officiating Deputy Conservator, 4th grade.
			„ F. A. Leete	Officiating Deputy Conservator, 4th grade.	Officiating Assistant Conservator, 1st grade.
	14th November 1894.	Mr. M. Hill's return from privilege leave.	Mr. J. C. Tulloch	Ditto.	Ditto.

6.—PUNJAB GAZETTE.

16th November, 1894.—No. 543.—Mr. E. M. Coventry, Assistant Conservator of Forests, assumed charge of the Working Plans Branch on the afternoon of 15th March 1894, relieving Mr. A. M. Reuther, Deputy Conservator of Forests, transferred to Baluchistán.

23rd November, 1894. No.—573—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the dates specified against each :—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. W. P. Thomas (on furlough.)	Provisional Deputy Conservator of Forests, 1st grade.	Deputy Conservator of Forests, 1st grade.	10th April 1894.	*Vice* Mr. Dickenson, promoted to the class of Conservator of Forests—Government of India Gazette. No. F./1045, dated 19th October 1894.
Mr. E. Forrest ...	Officiating Deputy Conservator of Forests, 1st grade.	Provisional Deputy Conservator of Forests, 1st grade.	Ditto	
Mr. J. Ballantine (on furlough).	Provisional Deputy Conservator of Forests, 2nd grade.	Deputy Conservator of Forests, 2nd grade.	Ditto	
Dr. E. Dobbs ...	Officiating Deputy Conservator of Forests, 2nd grade.	Provisional Deputy Conservator of Forests, 2nd grade.	Ditto	
Mr. L. G. Smith	Provisional Deputy Conservator of Forests, 3rd grade, and Officiating Deputy Conservator of Forests, 2nd grade.	Deputy Conservator of Forests, 3rd grade, and Officiating Deputy Conservator of Forests, 2nd grade.	Ditto	
Mr. F. S. Barker (on sick leave).	Deputy Conservator of Forests, 4th grade.	Provisional Deputy Conservator of Forests, 3rd grade.	Ditto	
Mr. R. J. P. Pinder ...	Provisional Deputy Conservator of Forests, 4th grade.	Deputy Conservator of Forests, 4th grade.	Ditto	
Mr. A. E. Lowrie	Officiating Deputy Conservator of Forests, 4th grade.	Provisional Deputy Conservator of Forests, 4th Grade.	Ditto	
Mr. A. M. F. Caccia	Provisional Assistant Conservator of Forests, 1st grade, and Officiating Deputy Conservator of Forests, 4th grade.	Assistant Conservator of Forests, 1st grade, and officiating Deputy Conservator of Forests, 4th Grade.	Ditto	
Mr. E. M. Coventry	Assistant Conservator of Forests, 2nd grade, and Officiating Deputy Conservator of Forests, 4th grade.	Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade.	Ditto	

No. 574—In Panjab Government Notifications Nos. 424 aud 425 dated 15th August 1894, the word "Provisional" with reference to Mr. Caccia should be omitted.

No. 575—In Punjab Government Notifications Nos. 423 and 426 dated 15th August 1894, and No. 340 dated 31st August 1894, *for* "Officiating Assistant Conservator of Forests, 1st Grade," *read* "Provisional Assistant Conservator of Forests, 1st Grade," with reference to Mr. Coventry.

No. 576.—In Punjab Government Notification No. 425 dated 15th August 1894, the words "Provisional" should be omitted with reference to Mr. Pinder.

No. 577.—The following changes have taken place in the list of Forest Officers in the Associated Provinces with effect from the dates specified against each:—

Name.	Present grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. A. E. Lowrie	Provisional Deputy Conservator of Forests, 4th Grade	Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade.	27th Aug. 1894.	*Vice* Mr Calthrop, appointed to officiate as Conservator of Forests—Government of India Gazette Notification No. 972 F. dated 28th September 1894.
Mr. E. M. Coventry (on privilege leave).	Provisional Assistant Conservatorof Forests, 1st Grrde.	Provisional Assistant Conservatorof Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade.	Ditto.	
Mr. G. F. Taylor	Officiating Deputy Conservator of Forests, 3rd Grade.	Officiating Deputy Conservator of Forests, 2nd Grade.	2nd Sept. 1894.	*Vice* Mr. Moore, on sick leave.
Mr. C. S. Smith	Officiating Deputy Conservator of Forests, 4th Grade.	Officiating Deputy Conservator of Forests, 3rd Grade.	Ditto.	
Mr. G. S. Hart	Officiating Deputy Conservator of Forests, 4th Grade.	Officiating Deputy Conservator of Forests, 3rd Grade.	3rd Sept. 1894.	Mr. Somers-Smith reverts, *Vide* orders in Government of India No. $\frac{879}{199}$—, dated 3rd September 1894.
Mr. C. S. Smith	Officiating Deputy Conservator of Forests, 3rd Grade.	Officiating Deputy Conservator of Forests, 4th Grade.	Ditto.	

Name.	Present grade.	Grade to which promoted or reverted.	With effect from.	REMARKS.
Mr. H. Calthrop	Officiating Conservator of Forests.	Officiating Deputy Conservator of Forests, 3rd Grade.	25th Octr. 1894.	Mr. Calthrop reverts.
Mr. G. S. Hart	Officiating Deputy Conservator of Forests, 3rd Grade.	Officiating Deputy Conservator of Forests, 4th Grade.	Ditto.	
Mr. J. H. Lace	Deputy Consertor of Forests, 3rd Grade. (on furlough).	Officiating Deputy Conservator of Forests, 3rd Grade.	27th Octr. 1894.	Mr. Lace returns from furlough.
Mr. G. F. Taylor	Officiating Deputy Conservator of Forests, 2nd Grade.	Officiating Deputy Conservator of Forests, 3rd Grade.	Ditto.	
Mr. A. E. Lowrie	Provisional Deputy Conservator of Forests, 4th Grade, and Officiating Deputy Conservator of Forests, 3rd Grade.	Provisional Deputy Conservator of Forests, 4th Grade.	Ditto.	
Mr. E. M. Coventry ...	Provisional Assistant Conservator of Forests, 1st Grade, and Officiating Deputy Conservator of Forests, 4th Grade.	Provisional Assistant Conservator of Forests, 1st Grade.	Ditto.	

28*th November*, 1894.—No. 589.—On return from the furlough granted to him in Punjab Government Notification No. 192, 11th March 1893, Mr. J. H. Lace, Deputy Conservator of Forests, reported his arrival in Karáchi on the forenoon of 25th October 1894, and in Lahore on the forenoon of 27th idem.

Mr. Lace is posted to the Jhelum Forest Division of which he resumed charge on the forenoon of 2nd November 1894, relieving Bhài Sadhu Singh, Extra Assistant Conservator of Forests, who remains attached to the Division.

7.—CENTRAL PROVINCES GAZETTE.

3rd November, 1894.—No. 4.—With the previous approval and sanction of the Chief Commissioner, Central Provinces, the following Forest Rangers are posted as Working-Plans Assistants to the Forest Divisions entered against their names :—

Mr. Narayan Pershad	... Raipur.
Mr. J. P. Haslett	.. Balaghat.
Mr. B Inamati Shama Rao	... Chhindwara.
Mr. Chhoga Lall	... Bilaspur.
Mr. Kundun Lall	... Sambalpur.

7th November, 1894 —No. 4844.—Leave on Medical certificate for six months, under Article 369 of the Civil Service Regulations, is granted to Mr. R. C. Milward, Assistant Conservator of Forests, with effect from the 18th October 1894, on which date he availed himself of it.

8th November, 1894. —No. 4890.—On return from the leave granted him by the following notifications and orders, Mr. F. S. Barker, Deputy Conservator of Forests, is posted to the charge of the Chhindwara Forest Division :—

Notification No 47, dated the 4th January, 1893.
Notification No 970, dated the 20th February, 1893.
Notification No. 3558, dated the 2nd August, 1893.
Order No. 435, dated the 20th January, 1894.
" " 4361 " " 4th October, 1894.

No. 4891.—On being relieved by Mr. F. S. Barker, Deputy Conservator of Forests, Mr W. G. Gilmore, Forest Ranger, is appointed as Working-Plans Assistant in the Chhindwara Forest Division.

14th November, 1394.—No. 5010.—With reference to Order No. 4358, dated the 4th ultimo, Mr. W G Gilmore, Forest Ranger, in the Chanda Forest Division, and Mr P. H Clutterbuck, Officiating Deputy Conservator of Forests and Forest Divisional Officer, Chhindwara, respectively assumed and surrendered charge of the Chhindwara Forest Division on the afternoon of the 31st idem.

15th November, 1893.—No. 5040 —Mr. N. C. McLeod, Extra-Assistant Conservator and Working-Plans Assistant, Bhandara, returned from the three months' privilege leave granted to him by Order No 3120, dated the 11th July 1894, and resumed charge of the duties of Working-Plans Assistant in that Division on the afternoon of the 6th instant.

22nd November, 1894.—No. 5172.—With reference to Order No. 4357, dated the 4th ultimo, Mr. P. H. Clutterback, Officiating Deputy Conservator of Forests, assumed charge of the duties of Working-Plans Officer (on deputation to the Chanda Division) at Nagpur, on the forenoon of the 13th instant.

22hd November 1894 —No 5174 —On return from the privilege leave granted him by Order No. 3118, dated the 11th July 1894. Mr. R. C. Thompson. Extra Assistant Conservator of Forests, and Working-Plans Assistant, assumed charge of his duties in the Saugor Forest Division on the forenoon of the 16th October 1894.

22nd November 1894.—No. 5224.—The privilege leave for one month, granted to Mr. H. Moore, Deputy Conservator of Forests, Betul, by Order No. 4070, dated the 12th September 1894, is commuted into one year's furlough on medical certificate under Article 343 of the Civil Service Regulations.

8.—BURMA GAZETTE.

29th October 1894.—No 401.—Under the provisions of Article 291 of the Civil Service Regulations, privilege leave for one month is granted to Mr. R. F. Lowis, Extra Assistant Conservator of Forests, with effect from the 9th November 1894, or the subsequent date on which he may avail himself of it

2nd November 1894.—No. 417.—The undermentioned officer has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave :—

Mr. J. W. Oliver, Conservator of Forests.

5th November 1894.—No. 418.—In exercise of the power conferred by section 70 of the Burma Forest Act, 1881, the Chief Commissioner empowers every Assistant and Extra Assistant Conservator of Forests, who has passed the prescribed examination in Forest law and in Burmese by the higher standard, to exercise the powers specified in clauses (*c*) and (*d*) of that section.

No. 419.—In exercise of the power conferred by section 68 (I) of the Upper Burma Forest Regulation, 1887, the Chief Commissioner empowers exery Assistant and Extra Assistant Conservator of Forests, who has passed the prescribed examination in Forest law and in Burmese by the higher standard, to exercise the powers specified in clauses (*c*) and (*d*) of that section.

No. 421 —The undermentioned officer has been granted extension of leave by Her Majesty's Secretary of State for India :—

Mr. A. M. Burn-Murdoch, Assistant Conservator of Forests, leave on medical certificate for six weeks.

No. 422 —The undermentioned officer has been granted permission by Her Majesty's Secretary of State for India to return to duty within the period of his leave :—

Mr. C. W Palmer, Deputy Conservator of Forests.

6th November 1894.—No. 425,—With the previous sanction of the Government of India the Chief Commissioner directs that the Shwegyin and Toungoo Forest divisions shall be transferred from the Pegu Forest Circle to the Tenasserim Forest Circle, and that the head-quarters of the Conservator of Forests, Tenasserim Circle, shall be transferred from Moulmein to Rangoon.

7th November 1894.—No. 24.—Mr. C. E. Muriel, Deputy Conservator of Forests, reported his return from the three months and fifteen days privilege leave granted him in Revenue Department Notification No. 246 (Forests), dated the 19th June 1894, and resumed charge of the Pyinmana division from Mr. S. Carr, Assistant Conservator of Forests, on the forenoon of the 4th instant.

8th November 1894.—No. 428.—Under the Provisions of Article 340 (*b*) of the Civil Service Regulations, furlough for two years is granted to Mr. J. T. Jellicoe, Deputy Conservator of Forests, with effect from the 1st December 1894, or the subsequent date on which he may avail himself of it.

8th November 1894 —No. 429.—Mr. H. Carter, Assistant Conservator of Forests, is transferred from the Working Plans division, to the charge of the Rangoon division, with effect from the date on which Mr. J. T. Jellicoe, Deputy Conservator of Forests, avails himself of the leave granted to him in this Department Notification No. 428, dated the 8th November 1894.

5th November 1894.—No. 22.—In pursuance of the instructions conveyed in Revenue Department Notification No. 425 (Forests), dated the 6th November 1894, the Shwegyin and Toungoo divisions were transferred from the Pegu to the Tenasserim Forest circle, with effect from the 15th November 1894.

15th November 1894, —No. 20.—With reference to Revenue Department Notification No. 358 (Forests), dated the 14th September 1894, Mr. R. F. Lowis, Extra Assistant Conservator of Forests, reported his arrival at Pakôkku, on the forenoon of the 28th and assumed charge of his duties on the forenoon of the 30th October 1894.

16th November 1894.—No. 25.—Mr. H. Jackson, Deputy Conservator of Forests, reported his return from the three months and 15 days privilege leave granted him in Revenue Department Notification No. 248 (Forests), dated the 16th June 1894, on the afternoon of the 14th instant, and resumed charge of the Southern Shan States Forest Division from the same date

17th November 1894.—No. 21 —Mr. R. F. Lowis, Extra Assistant Conservator of Forests, Yaw division, availed himself on the forenoon of the 12th Fovember 1894 of the one month's privilege leave granted him in Revenue Department Norification No, 401 (Forests), dated the 29th October 1894.

No. 22.—With reference to Revenue Department Notification No. 391 (Forests), dated the 19th October 1894, Mr C. W. Allan, Extra Assistant Conservator of Forests, received charge of Paungbyin subdivision, Upper Chindwin division, from Mr. I W. Anthony, Forest Ranger, on the afternoon of the 1st November 1894.

20th November 1894.—No. 26.—Mr. Hearsey returned to duty from the examination leave granted him in Notification No 359 (Forests), dated the 17th September 1894, on the forenoon of the 5th instant, the date on which he presented himself for the examination in Burmese at Katha and resumed charge of the Shwegu subdivision from Mr. E. S. Carr on the afternoon of the 7th instant.

No. 437.—The following postings and transfers are ordered in the Forest Department :—

Mr. C. W. Palmer, Deputy Conservator of Forests, on his return from leave to the charge of the Henzada-Thongwa Forest division.

Mr. H B Anthony, Deputy Conservator of Forests, from Henzada to the charge of the Southern Shan States Forest division.

Mr. H. Jackson, Deputy Conservator of Forests, on return from leave to the charge of the Ruby Mines Forest division.

Mr C. R. Dun, Assistant Conservator of Forests, from Katha to the Tharrawaddy Forest division.

9.—ASSAM GAZETTE.

22nd November 1894.—No. 7829G.—Mr. W. F. Lloyd, Officiating Deputy Conservator of Forests, on special duty at the Office of the Conservator of Forests, is transferred to Dibrugarh and placed in charge of the Lakhimpur Forest Division with effect from the date on which he receives charge from Mr. R. H. M. Ellis.

22nd November 1894 —No. 7830G.—Babu Tara Kisor Gupta, Extra Assistant Conservator of Forests, on return from privilege leave is placed in charge of the Nowgong Forest Division, with effect from the date of taking over charge from Babu Nilkanta Mukharji.

10.—HYDERABAD RESIDENCY GAZETTE.

22nd November 1894.—No. 376.—Mr. R. M. Williamson, Assistant Conservator of Forests, has, on being relieved by Mr. Sreenivasulu Naidu of the charge of the Amraoti Forest Division, been appointed to the charge of the Ellichpur Forest Division during the employment of Mr. H. Calthrop as Officiating Conservator of Forests, Hyderabad Assigned Districts, or until further orders.

25th October 1894.—No, 380—The Resident is pleased to declare that at the Departmental Examination held at Amraoti on the 17th and 8th September 1894, under section 72 of the Forest Department Code, the undermentioned Forest Officers in the Hyderabad Assigned Districts passed in the subjects specified against their names :—

Mr. R. M. Williamson, Assistant Consevator, 2nd grade.	Land Revenue, Forest Law (with credit), Procedure & Accounts (with credit.)
Mr. B. Bhukan, Extra Assistant Conservator, 4th grade.	Forest Law, Procedure and Accounts.

ON

MIXED FORESTS,

AND

THEIR ADVANTAGES OVER PURE FORESTS.

BY

JOHN NISBET, D.OEC.,

OF THE INDIAN FOREST SERVICE; AUTHOR OF "BRITISH FOREST TREES AND
THEIR SYLVICULTURAL CHARACTERISTICS AND TREATMENT," TRANSLATOR
OF KAUSCHINGER-FURST'S "PROTECTION OF WOODLANDS," ETC.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

1893.

TABLE OF CONTENTS.

On Mixed Forests, and their Advantages over Pure Forests.

Page
Introduction - - - - - - - - 3
The Advantages of Mixed Timber Crops - - - - 6
Rules for the Formation of Pure Forests - - - - 18
Rules for the Formation of Mixed Forests - - - - - 20
Mixed Crops of :—
  Shade-bearing Species - - - - - 22
  Shade-bearing and Light-demanding Species - - - - 23
  Light-demanding Species - - - - - 28
Recapitulation - - - - - - - - 29

ON

MIXED FORESTS,

AND

THEIR ADVANTAGES OVER PURE FORESTS.

In an interesting article on "*Woodlands*," published in the "*Nineteenth Century*" for July 1891, page 33, Sir Herbert Maxwell, Bart., says:—

> "One chief hindrance to our woodlands being remunerative may be stated at once,—we are arboriculturists and sportsmen, not foresters. A large proportion of the land, returned as woodland, is really pleasure-ground and game-cover. Thousands of landowners follow, on a smaller scale, the example set by the State on a larger in the New Forest and Windsor Forest. *Mixed planting is generally practised, in sharp contrast to what continental foresters call 'pure forest'—that is, a woodland composed of one species of tree. This is in itself a hindrance to profitable management, because pure forest is much more easily tended than mixed plantations, and the timber is more readily marketable.*"

There can be no clearer proof than the above of the genuine need for some properly qualified instruction in forest science in Britain. It shows how a very intelligent owner of woodlands can hold and, in attempting to teach his fellow-proprietors, can boldly disseminate most incorrect ideas concerning the true nature of forest growth, and the natural requirements of the various species of our forest trees. Here is what Professor Gayer of Munich, the greatest living authority on sylviculture, says on the subject*:—

> "One can say that during the last 30 to 40 years it has been a consistently emphasised leading principle of the Bavarian State Forest Department to recommend as much as possible the extension and maintenance of mixed forests in all localities in any way suitable for their growth, and the principle, too, has been acted on in many places. In many other localities, however, and especially in the spruce tracts, mercantile considerations gained influence and retained precedence, and the thought of a suitable admixture of species was, to a certain extent, pushed into the background, rendering it now very difficult to effect with satisfactory results a retransformation to the former state of things. All the more emphasis is consequently now being laid on the retention of mixed growth, especially in regard to retaining it in crops of older growth which are still classifiable as mixed forests, and endeavours are in general being made to prepare

---

* "*Zeitschrift für Forst-und Jagdwesen*" for June 1892, page 386.

the way for a return to mixed forests in all suitable localities. And that, face to face with the late fearful devastations* in the spruce forests of Southern Bavaria, these principles should be even more strongly insisted on can easily be understood."

He also adds advice of good practical value as follows† :—

"Considering the circumstances of the timber market in general now-a-days, and of local demands, and considering also their incontestibly thriving growth, no argument is required to show that the conifers, and in particular spruce, must nearly everywhere claim the lion's share in the composition of the mixed forests of the future."

Considering how well the Douglas fir seems to thrive in Britain, and how good the quality of its timber promises to be, this species of tree deserves to be classed even before the spruce in being recommended to the attention of sylviculturists.

Mixed forests have the great advantages of denser growth, larger and finer production of timber both as regards quantity and technical quality, and lessened danger from storms, snow, ice, insects, fire, and fungoid disease. Against all of these inestimable and solid advantages the only drawback that can be named is that the tending of such woods is much more difficult, and that their formation and management require considerably greater knowledge of sylviculture, than is requisite for the treatment of pure forests.

In France, where forestry is well understood and practised, although not quite so scientifically as in Germany, mixed forests form the bulk of the woodlands. According to Mathieu's statistics for 1876, they occupy over 70 per cent. of the total wooded area, which is composed as follows‡ :—50·3 per cent. mixed forests of broad-leaved, deciduous species, 17·6 per cent. mixed crops of broad-leaved trees and conifers, 2·5 per cent. mixed crops of conifers, and 26·7 per cent. pure forests of various species, leaving 2·9 per cent. unclassed. In Germany, according to the imperial statistics for 1884, the total area under forest consists of 65·5 per cent. of conifers and 34·5 per cent. of broad-leaved species, but the area of mixed forests is not given.

Wherever ancient forests still exist, or wherever woodlands remain whose previous history can be traced back for any length of time, it will almost invariably be found that in their original natural condition they were undoubtedly classifiable as mixed woods, and that if they now cover the soil as pure crops this has either been due to artificial means brought into operation for financial reasons, or has been the result of negligence in allowing a shade-bearing species to oust kinds of trees that make greater demands on light. Owing to the ease with which they can be made to establish themselves, their rapid growth during youth, and the promise they give of yielding comparatively high returns for the capital represented by soil and growing stock, pure forests of coniferous species (Scots pine and spruce in particular) have in very many cases, both at home and abroad, been chosen to replace the former crops of mixed species.

---

* By insects, in particular *Liparis monacha*, 1889–91.

† *Op. cit.*, page 386.

‡ Gayer, "*Der gemischte Wald*," 1886, page 9.

In weighing the advantages and disadvantages of mixed forests the following points may be considered* :—

Advantages :—

1. A greater density of crop is attainable.
2. The soil is retained in better condition and productive capacity than under many pure crops.
3. A larger percentage of timber is available for the higher technical purposes, at any rate in mixed forests of deciduous, broad-leaved species.
4. Demands of varying nature for timber can more easily be supplied.
5. It is easier to modify or transform the crop at any time, so as to meet the present or the probable future requirements of the market.
6. EXPERIENCE HAS SHOWN THAT MIXED FORESTS ARE MUCH LESS EXPOSED THAN PURE FORESTS TO DANGER FROM EXTERNAL CAUSES, WHETHER OF ORGANIC OR INORGANIC ORIGIN.
7. Natural reproduction or regeneration of mixed woods is on the whole easier than in the case of pure crops.
8. By concentration of various species in one series of crops, the operations of tending, harvesting, &c. can be conducted most economically.

Disadvantages are summed up by Gayer in the following words† :—

> "It is easy to understand that mixed crops make higher demands on the capacity of the forester, as it is much more troublesome and difficult to give proper care and attention to each of several species in a mixed crop than to look after one species only; but when weighed against the many important advantages offered by mixed crops, this drawback can surely seldom be seriously taken into account."

To satisfy any who have doubts on the subject, it may be well to state the above-named advantages again seriatim, adding a word of explanation or proof to sustain what has been asserted.

---

* Gayer, "*Der Waldbau*," 3rd edition, 1889, pages 215, 216.

† "*Der Waldbau*," 3rd edition, 1889, page 216.

THE ADVANTAGES OF MIXED TIMBER CROPS.

1. *A greater Density of Crop is attainable.*—Most forests of any considerable extent exhibit almost constantly varying qualities of soil and situation in regard to exposure, depth of soil, quantity of moisture, &c., and a complete utilisation of the soil can only be hoped for when each portion is stocked with the species best suited for growth there. The various species thus growing in admixture over the patches of soil best adapted to their requirements do not thin themselves so early as they otherwise would on land less suited to their normal development, and they maintain close canopy for the longest possible period, thereby not only fully availing themselves of the productive capacity of the soil, but also of the chemical power of light and sunshine in the assimilative work carried on by the foliage. This closer canopy and greater density of crop becomes of all the more importance the older the crops grow, and the nearer they approach maturity.

2. *The Soil is retained in better condition and productive capacity than under many pure Crops.*—Pure woods of light-demanding species of forest trees, like oak, ash, maples, larch, and pine, when once they have finished their chief growth in height and have begun to assert their natural desire for increased growing-space, are (without underplanting) unable to conserve the productive capacity of the soil owing to the interruption of canopy, the diminution in the number of individuals forming the crop, and the consequent bad effects of insolation and drying-up winds on the surface-soil. But as these light-demanding species are at the same time of more rapid growth than shade-bearers, like beech, spruce, silver fir, and hornbeam, during the earlier periods of development, they usually in mixed crops assert themselves, with assistance now and again in the way of tending wherever necessary, as the predominating poles and trees, thereby acquiring the position naturally best suited for their growth and further good development. At the same time the shade-bearing species, forming the dominant and subdominant classes of the crop, mechanically protect the soil against the exhausting and deteriorating influences of sun and wind, and also by the richer fall of dead leaves contribute valuable material for the formation of *humus* or vegetable mould, that natural manure of woodlands which exerts a most beneficial influence in toning down all extremes in the physical properties of soils.

Pure forests make constant, one-sided demands on the soil, so that in many cases there is far greater risk of one particular class of nutrients being rapidly diminished than when a variety of species tends towards a more general demand for the various kinds of mineral food-substances. And there can be little doubt that G. L. Hartig's old theory,—that the soil could be most thoroughly utilised by an admixture of shallow-rooting species with deep-rooting, in order that each might draw its main supplies of nutriment from a different layer of soil,—although long scoffed at by a certain class of sylviculturists (headed by Hundeshagen), who saw the advisability of admixture explained solely by the relation of the various species towards light and shade, seems perfectly correct, both in theory and in practice. That the productive capacity of the soil is better utilised cannot be doubted. Experiments conducted in Silesia in 1880 showed that on soil similar as to conditions and quality, the average annual increment of 80-year-old crops was:—

Pure forest of Scots pine -	18·8 cubic feet per acre.
" " spruce -	19·9 " "
Mixed forest of Scots pine, spruce, and silver fir.	28·5 " "

Beneficial as the influence of overshadowing the soil undoubtedly is, there are cases in which even it may be carried further than is desirable. Thus, in dense forests of pure spruce, the thickly-foliaged canopy overhead and the deep sponge-like growth of moss covering the soil intercept and retain a very much larger proportion of the atmospheric precipitations, both in winter and in summer, than deciduous trees or other coniferous species (pines) with somewhat thinner growth of foliage. To these causes are assignable the dried-up appearance that soils under pure spruce woods sometimes assume in early summer, just at the time when transpiration and assimilation are becoming most active, and when the greatest necessity exists for a free supply of moisture from the soil so as to permit of the assimilative and productive processes being carried on to their fullest possible extent.

In former times, when the work of nature was comparatively uninterfered with, and mixed woods almost everywhere formed the covering of the uplands and the hilly tracts unsuited, or not yet required, for arable land or pasturage, rain and snow were more equably precipitated on the soil itself, and were not so apt to be sucked up and retained by a strongly hygroscopic surface-growth of mosses or weeds, which likewise is exceedingly active in afterwards utilising or even exhausting the supplies of moisture contained in the upper layer of the soil. The aqueous precipitations were, on the other hand, preserved by a good layer of dead leaves, and of humus or mould resulting from their decomposition, and were allowed to percolate normally into the soil and down towards the subsoil, so as to maintain a tolerably equable distribution throughout the whole, owing to the effect of gravity being counterbalanced by capillarity. Whilst in France Boussingault has proved that with increase in the area stocked with conifers a gradual local sinking of the water-level below the soil has taken place, practical sylvicultural experience in Germany has also shown that—except at high elevations with a damp climate—extensive plantations of pure spruce rapidly lead to a marked decrease in the quantity of soil-moisture. Runnebaum's comparative experiments in 1885 likewise showed that in mixed woods of Scots pine with beech the conditions relative to soil-moisture were more favourable for tree-growth than in pure forests of pine. It is, however, only right to point out that this must to a certain degree be ascribed to the influence exerted on the soil by the good humus or mould formed by the dead foliage of the beech, which is particularly rich in potash.

Despite its poor financial value as timber, beech is indirectly one of the most valuable and important of our forest trees, even from a purely financial point of view. By growing it in admixture with other species of a much greater technical and monetary value, these latter can be produced in shorter time, and therefore at less cost, and of larger and better-paid dimensions and quality than when grown either in pure forest or dissociated from the beech. This is not a suitable opportunity for entering into a full explanation of the physiological and sylvicultural reasons for this fact; but it may be remarked that it is mainly due to the generally slower development of the beech in comparison with the light-demanding species, to its capacity to grow well enough under their shade to maintain close canopy, although perhaps not to thrive luxuriantly, and to the excellent quality of humus formed by the decomposition of the dead foliage strewn over the soil. Where the beech is gradually removed entirely from the woodland crops, ousted by conifers promising speedier and higher financial returns, most of the light-demanding, valuable, deciduous, broad-leaved species are at the same time ostracised.

Gayer's opinion is as follows * :—

"There are many localities in which beech will continue to be a valuable wood from a financial point of view" (*i.e.* for fuel in Germany), "but where such may not be the case, it will still retain its insurpassable sylvicultural value, for without the

---

* "*Waldbau*," 1889, page 448.

> beech there can no more be properly tended forests of broad-leaved species, as along with it would have to be given up a good many other valuable timber trees, whose production is only possible with the aid of the beech."

Even although the sycamore has in our damp, insular climate undeniably a thicker leaf-canopy, and a greater capacity for enduring shade, than it is endowed with on the continent, yet it is not so well adapted as the beech for being the matrix of mixed forests. Yet its dead foliage is richer in mineral ashes and in phosphoric acid than beech leaves.*

3. *A large percentage of Timber is available for the higher technical purposes, at any rate in mixed Forests of deciduous broad-leaved Species.*—As already above indicated, many of our more valuable timber trees are, when once they have passed through the initial stage of pole-forest, by nature so light-demanding and so dependent on increase of growing-space, if they are to continue in vigorous growth and normal development, that they are unable of themselves to maintain such degree of density of canopy as is necessary to retain and duly conserve the productive capacity of the soil, and to prevent it ultimately becoming to a greater or less extent deteriorated.

And even if, on the better classes of soil, pure forests of such species, or mixed crops of the more valuable light-demanding trees only (oak, ash, maples, larch, pine, &c.), be grown without admixture of any shade-bearing species, their love of light and naturally rapid process of thinning themselves out, favour branch development to an extent quite inconsistent with the purely financial and sylvicultural treatment of woodlands. This, too, is a drawback not even affected by underplanting for soil-protection. Thus an admixture of one or other of the chief shade-bearing species (beech, hornbeam, spruce, silver fir) not only protects and stimulates the productive capacity of the soil, but also acts directly and mechanically in preventing the formation of short boles and of strong branches interfering with the technical utility and market value of the individual trees forming the crop. The admixed shade-bearing species performs in this respect identically the same rôle as underwood when it grows up into the crowns of the standards, and what I have elsewhere said on this subject may be repeated here † :—

---

* See Ebermayer's *Analyses of Foliage*, *Forstlich-naturwissenschaftliche Zeitschrift*, 1893, pp. 230, 231. The greater value of beech may prove to be due to the action of the *Mycorhiza* on the rootlets, and to a more thorough aeration of the soil.

† See essay "*On the Advantages of Underplanting the light-demanding, thinly-foliaged Species of Forest Trees*," page 22.

"That the underwood is also of practical utility in clearing the lower branches from the stems hardly needs any demonstration. As it gradually climbs up into the lower portions of the crowns, it not only suppresses the foliage of the lower branches that can still maintain a struggling existence under the partial shade of the crowns, but otherwise aids mechanically in breaking off dead branches; by maintaining the soil cool and moist, it also assists materially in hastening their decomposition.

* * * * *

"From the experiments it seems warrantable to conclude that the older the underwood and the higher up it reaches into the lower portion of the crown, the greater is its influence in improving the form-factor and the consequent utility and technical and financial value of the stem. * * * ."

It is a matter of practical experience that pine and larch form more valuable boles and a larger percentage of heart-wood when grown in company with spruce or silver fir than in pure forests; also that all the better species of deciduous trees gain in shape, increment, and age up to which they can continue to thrive in a technically, as well as financially, healthy and desirable condition, when the beech or hornbeam forms part of the crop. And these beneficial effects are even more plainly visible when, on suitable soils, the mixed crops are formed of conifers and broad-leaved trees, even though all may be shade-bearing, as in the case of spruce and silver fir grown along with beech.

Thus, as shown under sections 1 and 2, the total quantity of timber produced is not only greater in mixed than in pure crops, but the predominating trees form longer, more cylindrical, and cleaner stems, whose freedom from branches and knots gives the timber its highest possible value for technical purposes, owing to the superiority of its various technical properties from every point of view. That such higher-class timber will of course be readily disposable at a better price than ordinary rates is self-evident.

4. *Demands of varying nature for Timber can more easily be supplied.*—This has also very much that is axiomatic about it, for it stands to reason that where several species of trees are grown together on the same area, the classes of material periodically yielded during the necessary operations of tending, thinning, and removal of diseased individual stems, will offer a much greater variety to the different classes of local consumers than is possible in the case of pure forests. When the mature crop comes to be harvested, the same holds good. And whilst changes in the local demands can be the more easily satisfied, the wider and more general requirements of the timber marts at various distant centres can be better met than in pure forests. There is also much less chance of over-production of any species or assortment to such an extent as might possibly glut the market even temporarily, and thus cause a marked fall in the prices obtainable.

5. *It is easier to modify or transform the Crop at any time, so as to meet the present or the probable future requirements of the market.*—Notwithstanding the present extensive and ever increasing use of substitutes like iron instead of timber, and the vast improvements in communication through which the produce of the forests of distant countries can be profitably made to supply our home timber-markets, this commodity is, along with gold, almost the only one which has not during the past half century depreciated in relative value along with most other articles of commerce. But all classes of timber do not alike command favourable market quotations. Only the skilful forest administrator will know from a study of the market rates, the stocks of timber held at the chief marts, and the reports as to the quality of imports coming from other countries, what kinds and classes of timber are likely to be most remunerative in the immediate future; and it stands to reason that he will be in a much better position to tend and foster that species which holds out the best financial promises, when several species are growing together in mixed woods, than if they are segregated as pure forests, each worked independently of the other crops. And again, when present market rates offer inducements for the speedy clearance and sale of certain classes of timber, advantage can much more easily and conveniently be taken of the favourable opportunities of disposal without at the same time threatening the well-being of the woodlands by departing to a greater or less extent from the normal course of treatment prescribed by the provisions of the working-plan. In fact, when the whole growing-stock consists of one series of falls of mixed woods, varying in age from zero to maturity, in place of having a similar series for each of the species of trees grown by themselves in pure forests, the working-plan is capable of much greater elasticity of treatment, and affords better scope for the somewhat premature utilisation of portions of crops whenever the market may be exceptionally favourable for that particular class of timber, without necessarily exposing the soil to deteriorating influences tending to weaken its productive capacity. By removing or diminishing the number of individuals of other species during the usual, or if necessary by means of special, operations of tending and thinning, the probable immediate future requirements of the available timber marts can be more economically, conveniently, and speedily provided for than when one has to deal with pure forests only.

To give one practical example only, the safety-match industry may be briefly referred to. The woods best adapted for the manufacture of these matches in Norway, Sweden, and Germany are willows, aspen, and poplar, but it very frequently occurs that the match-factories have to be removed from one district to another on account of the supplies of suitable timber falling short of their requirements. The heavy expenses thus involved mean that if steps were taken to provide continuously a sufficient supply of the requisite assortments of softwoods, the factory proprietors could well afford to pay enhanced rates for all suitable timber offered to them; but unless these species are already well represented in mixed woods, their cultivation could only be favoured when once the existing crops on the woodland area have attained maturity and been harvested. If, however, the softwoods are already growing on the patches best suited to them, the owner can encourage their growth easily, and thus avail himself of the favourable market offered.

6. EXPERIENCE HAS SHOWN THAT MIXED FORESTS ARE MUCH LESS EXPOSED THAN PURE FORESTS TO DANGER FROM EXTERNAL CAUSES, WHETHER OF ORGANIC OR INORGANIC ORIGIN —Shallow-rooting species (like spruce), when mixed with deeper-rooting kinds of trees (like pine, larch, silver fir), are much less exposed to damage from storms than when growing by themselves. When grown along with deciduous broad-leaved species, conifers of all kinds suffer also much less from storms, fire, damage from snow, ice, or frozen sleet, insects, and fungoid diseases than when grown in pure crops, or even in mixed crops of conifers only. Associated along with broad-leaved trees, the conifers generally attain a better development than under other circumstances, so that they are less liable to the attacks of insect enemies; these latter are also better kept in check by the birds that feed on them, and which are more numerous among deciduous trees than conifers. Even should attacks of insects occur they seldom spread widely over all species, and never necessitate total clearance of the whole crop, as so often unfortunately happens in the case of pure woods of spruce and Scots pine. Species too, like oak, that are somewhat sensitive to late frosts during the early period of their growth, are apt to suffer less damage when under the protection of hardier kinds of quicker development, like birch or pine. In mature mixed woods of conifers and broad-leaved species the technical value of the boles is less likely to be diminished by frost-shakes than when these latter are grown by themselves. The woodland proprietors of Scotland know from bitter experience what ravages can be wrought in pure larch forests by the fungoid

disease, due to *Peziza Willkommii*, causing cankerous outbreak on the stems and inducing crooked growth; whilst in pure spruce, silver fir, and pine forests red-rot and diseases of the stem and root-system, occasioned by *Trametes radiciperda, T. pini, Aecidium elatinum, Agaricus melleus, Peridermium pini*, &c., are often productive of most serious sylvicultural and financial results. Speaking of that infant ailment of the Scots pine, "*leaf-shedding*,"—due in some cases to the drying-up of the needles when sunshine in winter and early spring stimulates the foliage to action whilst the soil is still frost-bound, and the root-system incapable of obtaining the requisite supplies of moisture, but in very many other cases undoubtedly caused by the attacks of a fungus, *Hysterium pinastri*,—Gayer says[*] :—

> "About 80 years ago the sporadic occurrence of '*leaf-shedding*' in Scots pine was merely '*an interesting observation*,' whereas now it is nothing short of a wide-spread calamity all over Germany. At first two to four-year-old seedling-growth was chiefly attacked, but now-a-days sowings and plantations are both liable to be affected, and it is even beginning to attack young thickets. And wherewith shall we replace the Scots pine, if even it refuse to serve our purposes? R. Hartig says at page 40 of his book on the 'Diseases of Trees'[†] :—'*The best prophylactic measure* '*against the occurrence and spread of epidemics is the cultivation of mixed forest* '*crops*.'"

But it is perhaps more in regard to injuries caused by insect enemies than in any other way that the beneficial effects of the formation of mixed crops may be judged of as far as spruce and Scots pine are concerned. Simultaneously with the disappearance of the natural mixed crops that can be proved to have formed the chief portion of the soil-covering of wooded areas throughout Germany during the first quarter of the present century, and with the formation of extensive pure forests of coniferous species, the damage done by insect enemies has increased enormously, and has on many occasions during the past half-century risen to the height of calamities, sometimes of national importance. Thus, in speaking of the ravages caused by the black arches, "Nun" or spruce moth (*Liparis monacha*), which, together with the bark-beetles (*Bostrichini* and *Hylesini*) that followed in its wake attacking the sickly stems left alive, between 1853 and 1862 devastated the coniferous forests of Eastern Prussia and Western Russia over about 7,000 geographical square miles, and necessitated the felling of over 420,000,000 cubic feet of timber, Hess[‡] recommends, as the first measure of prevention, "*avoidance of the formation of pure forests of spruce*

---

[*] "*Der gemischte Wald*," 1885, page 24.

[†] "*Lehrbuch der Baumkrankheiten*," 1882 (2nd edition, 1889).

[‡] "*Der Forstschutz*," Vol. I., 1887, page 355.

or Scots pine; formation of mixed crops of suitable species." This same insect has also recently in Southern Bavaria (1889–1891) necessitated the clearance of 40,000 acres, mostly of pure spruce, and has involved a special outlay during the present year (1892) of £75,000 in order to prevent the continuation of the attacks in the State forests alone.* That the calamitous extent to which attacks by moths (*Bombycidæ*), bark-beetles (*Scolytidæ*), and weevils (*Curculionidæ*) at present occur every now and again arises from want of due and natural admixture of species, there can be no doubt to anyone who has had opportunity of studying forestry on the grand scale on which it is conducted throughout Germany; and it cannot fail to strike one that, along with the extensive formation of pure coniferous forests for financial reasons, many different kinds of insects which were only injurious to an inconsiderable degree 30 to 40 years ago, must now be reckoned decidedly injurious, and often very much so.

That forests of broad-leaved species are not exposed in anything like so great measure to devastating attacks of insects is a well-known matter of experience. Even after crops may have been stripped of their spring flush of leaves, as sometimes takes place with the oak when there are swarms of the caterpillars of *Gastropocha processionea*, the injury is not of a permanent nature, owing to the much larger reserves of starchy and nitrogenous matter contained in broad-leaved kinds of trees, and the stronger reproductive and recuperative capacity with which they are thereby naturally endowed.

By admixture of broad-leaved species, and particularly of beech or hornbeam, along with conifers, the danger of attacks from noxious insects can be materially diminished without in any way impairing the other advantages derivable from the formation of mixed crops. Thus Danckelmann† states that woods which consisted of four-fifths Scots pine and one-fifth beech or hornbeam practically did not suffer at all in Prussia from any of the insect calamities occasioned by *Bombycidæ* between 1860 and 1880, whilst the pure pine woods suffered severely.

The beneficial effect of mixed crops in obviating extensive injuries from insect enemies is perhaps about the only point concerning which German sylviculturists are absolutely unanimous; and that such calamities, as have from time to time occurred in different parts of Germany, have not similarly taken place on a smaller scale in any part of Britain is, in my opinion, solely due to the happy chance or the prudent sagacity of woodland proprietors imitating nature by the formation of mixed woods in preference to forming pure forests over areas of considerable extent. Should Sir Herbert Maxwell's advice be acted on to any great degree, the days of such immunity will assuredly be numbered, for experience in Germany has undoubtedly shown that the number of dangerous insects is not only less in mixed woods, but that at the same time the number of insectivorous birds is greater than in pure forests.

---

* For the life-history of this insect and a description of its ravages, see the author's report in the "*Transactions of the Highland and Agricultural Society*," 1893.

† "*Zeitschrift für Forst-und Jagdwesen*," January 1881, page 1.

Glancing aside at Indian forest conditions, it may be remarked here that a useful lesson should be learned from the above with regard to our pure plantations of teak in Burma. It is only necessary to study the life-history of the two *Noctuidæ* of the teak tree (*Hyblæa puera* and *Paliga damastesalis*), whose appearance and attacks have already been described in the "*Indian Forester*," to realise that one day they may develop into a scourge of the plantations, against which we may find ourselves almost helpless.

What is true about dangers from injurious insects is also equally undeniable in regard to windfall and breakage from storms or in consequence of accumulations of snow and ice on the crowns of the trees. In these respects it is again the conifers that suffer to a far greater extent than the broad-leaved species, among which beech and elms are more apt to suffer than oak, ash, or maples. Although from its shallow root-system spruce is much more apt to become windfall than any other species, Scots pine is, on account of its brittleness or lesser degree of elasticity, more apt to have branches snapped off or the crown broken by either violent winds or heavy accumulations of snow and ice, and a year seldom goes past without the necessity of registering damage from both of these causes.

To prevent, so far as possible, damage from storms, Hess* recommends the admixture of deep-rooting species along with those whose root-systems are more superficial, and adds that "the injuries caused by storms during the last decade should be " a warning to those sylviculturists who are over-eager to " transform forests of broad-leaved species into coniferous " woods; such transformations should only take place when " justified by extreme necessity."

The accumulations of snow on the crowns of trees are less in mixed than in pure forests, especially when conifers are interspersed with broad-leaved trees; for, besides allowing the snow to reach the ground, the leafless crowns of the latter afford some slight support to the snow-laden crowns of the former, and even if breakage or pressure result it is more of an individual nature, and does not extend throughout the whole crop, as is so often the case in regard to spruce and pine. As the first measure to be adopted with a view to preventing the occurrence of snow-break in tracts exposed to such danger, Hess* lays down the "avoidance of the formation of pure forests of species liable to "suffer. Scots pine is entirely out of place in such localities. "So far as possible, broad-leaved species should be scattered in "sufficient quantity and at convenient distances throughout "spruce woods."

---

* *Op. cit.*, Vol. II. (1890), page 287.

7. *Natural reproduction or regeneration of mixed Woods is, on the whole, easier than in the case of pure Crops.*—This is, in comparison with many of the other advantages offered by mixed crops, but of minor importance, and is due to the special treatment and tending which must be bestowed on them so that each species of tree may, so far as possible, be placed in the natural conditions most favourable to its growth and further development. With some attention given towards securing for each species the soil and situation best adapted for it, healthier growth, larger secretions of starchy reserves, and richer production of seed are logical results; hence natural reproduction in small groups and patches is considerably easier and more likely to be successful than when one single species predominates over the whole area, notwithstanding the usually frequent changes in regard to depth of soil and quantity of soil-moisture. The tree which undoubtedly gains most in this respect is again the spruce, as, owing to the danger of windfall if seed-fellings were first made and then followed by gradual clearance of the parent standards, this method of treatment does away with the frequent necessity for total clearance and subsequent artificial reproduction, and thereby minimises the danger threatened to young seedling crops by weevils (*Curculionidæ*). The natural reproduction of the other great shade-bearing species—beech, hornbeam, and silver fir—offers in general but small difficulty, and in mixed forests these would usually be reproduced naturally and cleared away as speedily as possible, leaving the young seedling crop to grow up as underwood under the lightly-foliaged standards of other species. Douglas fir may also be treated thus.

In the regeneration of mixed woods it will be almost invariably found advisable to plant out strong transplants of the more valuable species of timber trees, as their disposal throughout the soil-protecting matrix or ruling species, and the advantage in age which it is desired to give them over it, are much better ensured by this than by any other means. But, at the same time, wherever special considerations of soil render the natural reproduction of the light-demanding species desirable, this can also be easily arranged for, the blanks remaining afterwards being filled up with one or other of the shade-bearing, soil-protecting species most likely to thrive on the given locality.

---

* *Op. cit.*, Vol. II. (1890), page 315.

8. *By concentration of various Species in one series of Crops, the operations of tending, harvesting, &c. can be conducted most economically.*—This is another self-evident advantage that should need no proof. Supposing, for the sake of example, that any woodland proprietor has 800 acres of forest land at disposal, which he wishes to have stocked with the four species—larch, Scots pine, spruce, and silver fir—worked with a rotation of, say, 80 years each. If formed in pure forests, when once the crops were in full working order to yield mature annual falls of timber, there would be four distinct series of annual crops from 0 to 80 years old, in place of one series of mixed crops of the same ages; and all operations of thinning, tending, felling, and extracting would have annually to be carried out in four different localities and over small areas of 2½ acres each, instead of being concentrated on one compact area of 10 acres in extent for each annual crop. This latter method represents a very great saving both in time and money; and when woodland estates are small the formation of mixed woods is practically the only way of obtaining an annual outturn of more than one kind of timber.

In the above I think it has been proved that a mixture of species in woodlands, far from being, as Sir Herbert Maxwell asserts, "*in itself a hindrance to profitable management,*" has many inestimable advantages over pure forests, not the least being the greater security with which the crops may be expected to attain their normal maturity. But in sylviculture there are no hard and fast rules applicable to all soils and situations, and circumstances can often occur not only to justify, but even to recommend, the formation of pure crops. As it has been well expressed by Heyer* :—

> "Notwithstanding the manifold and decided advantages which mixed forests offer in general, the formation of pure crops, to be permanently worked as such, is by no means precluded, for they in many cases offer such peculiar advantages as

---

* "*Der Waldbau,*" 4th edition, 1891, page 39.

render it advisable or even necessary to retain or form them. Where, for instance, the local market or the nature of the soil and situation (*e.g.*, when the soil is either very wet or very dry) is favourable to one particular species of tree only, that individual kind should be cultivated. *But, at the same time, such cases are rather exceptional, and as a rule the formation of mixed crops is certainly to be recommended.*"

In the primeval forests of Britain mixed woods of oak and beech covered most of the low-lying tracts and the better qualities of soil on the uplands; beech was the principal species on the limy hills of central and southern England; whilst Scots pine probably asserted itself over the poorer hill-sides, with patches of birch here and there. On the richer, deeper soil oak was of quicker growth than beech, and, growing in localities eminently suited to its requirements, could well regenerate itself naturally under the shade of the parent trees, as may even now be seen in pure woods on rich alluvial tracts. The great forests of the Highlands of Scotland were composed for the most part of Scots pine, because it was content with indifferent classes of soil where few other trees were able to dispute its foothold. A thick growth of moss helped it to maintain the productive capacity of the soil when it began to thin itself about the 20th to 30th year, and then became somewhat broken in canopy. In our damp insular climate this not only diminished the danger of soil-deterioration through sun and wind, but it also favoured good natural reproduction and the formation of a closer canopy. Scots elm, ash, alder, aspen, willows, and mountain ash were all practically confined either by their love of moisture, or of soil-fertility, or of both, to the ravines on the hillsides and the lower-lying tracts where the deeper and richer soil lay, and where the abundance of soil-moisture rendered a loose broken canopy and a light annual fall of leaves matters of no particular moment,—where often, in fact, superabundance of soil-moisture made the evaporating action of sun and wind beneficial rather than prejudicial. The wet soil, the severe winters, and the frequent late and early frosts in such humid localities safeguarded their domain from being encroached on by the oak or the beech. That most light-demanding but hardiest and most graceful of all our indigenous trees, the birch, was forced to seek its permanent home wherever no other species could assert a foothold and maintain themselves in growth.

RULES FOR THE FORMATION OF PURE FORESTS.

Whenever it is deemed advisable to form pure forests artificially the following rules laid down by Heyer[*] should be noted as having proved themselves sound both in principle and in practice:—

---

[*] *Op. cit.*, pp. 30–32.

I. *As a rule only those species should be grown in pure forests, which retain or increase the quality or productive capacity of the soil* *Such are:*—

1. *Those which are thickly foliaged, and grow in close canopy.*—These qualities are pre-eminently exhibited by the beech, spruce, Douglas and silver firs, and in a less degree by the hornbeam, lime, and chesnut. Whether or not the sycamore may also be included in this class for Britain, depends to a great extent on the mineral strength and freshness of the soil in each concrete case.

2. *Those lightly-foliaged conifers which are evergreen.*—The thick, spongy growth of *Hypnum* mosses that springs up when such woods begin the natural process of thinning themselves, and which acts like humus or mould in protecting the soil-moisture against the effects of sun and wind, gradually disappears when the canopy commences to become very much interrupted and broken. The utilisation and reproduction of such pure forests should, therefore, not be delayed too long. The species coming under this description are the various members of the pine genus, although Austrian (black or Corsican), Weymouth, and maritime pines are all more densely foliaged and maintain better canopy than our indigenous Scots pine.

II. *Such species as do not retain the productive capacity of the soil may, however, be grown in pure forests,*—

1. *When worked with low rotation.*—All species of forest trees protect the soil during the earlier stages of their development, because the crop is denser and the crowns of foliage are nearer the ground. This applies, along with other crops, to osier-holts and coppice-woods for example.

2. *When the productive capacity of the soil is not endangered by imperfect cover.*—Under this head are classifiable such cases as marshy soil, where evaporation of the moisture by insolation and by the free play of winds is directly beneficial,—or as valleys or low-lying tracts whose soil always remains fresh or damp, and whose depth and porosity would only be injuriously interfered with by an accumulation of humus. Alder and birch are not infrequently to be found on soils of such description, and

ash, elm, and oak on those of a better class formed by rich alluvial deposits.

It may be noted that in the above no provision seems made for such trees as larch and oak in general. Pure forests of these species may of course be formed under II. 1, but if they are to be maintained as pure forest to be worked at the ordinary periods of rotation for timber of their species, they should certainly be underplanted with a shade-bearing species to protect the soil. Many of the larch forests of Scotland would (from a sylvicultural point of view—but pasturage would then be out of the question) be much healthier and more vigorous in growth if they had been well thinned and underplanted with spruce about their 25th to 30th year. This is apparently anomalous, for larch forests occur pure in its Alpine home, though only at high elevations where the atmosphere is humid, where there is a strong tendency to the growth of moss even in such open forests, where the general growth of larch is much more vigorous, where there is greater approach to the maintenance of good canopy, and where, finally, the soil is protected by a deep covering of snow for most of the six to seven months of the year during which the tree is bereft of its foliage.

RULES FOR THE FORMATION OF MIXED FORESTS.

In the same way general rules for the formation of mixed crops can also be framed in accordance with the laws of nature and the principles of sylviculture. Those tabulated briefly by Gayer* are as follows:—

1. *The concrete conditions of soil and situation must be such as are favourable to the normal development of all species of trees intended to be grown in admixture.*—It would be erroneous to suppose that mixed crops are advisable only on the better classes of soil, although of course the quality of the latter is an important factor in determining the choice of species to be admixed. In fact it is on some of the poorer classes of soil that the greatest all-round advantages of mixed woods make themselves most apparent, particularly when the soils are of a sandy nature.

2. *The admixture of species must not be such as ultimately to endanger the productive capacity of the soil.*—This is practically the repetition of the first principle laid down in regard to the

---

* "*Der Waldbau*," 3rd edition, 1889, pages 216, 217.

formation of pure forests, and amounts in other words to the statement that the capital value of the woodland soil, *i.e.* its capacity for yielding interest or returns in timber under proper treatment, must not be tampered with, risked, or diminished by injudicious management.

3. *Throughout the whole period of rotation each species must find the due amount of growing-space and enjoyment of light, air, and warmth suited to its requirements.*—This condition is not at all confined to the development of the crown, but applies equally to the extension of the root-system, which becomes of the more importance the nearer the individual species approach to their physical maturity.

Proceeding from the general considerations that the possibility of forming mixed crops of various species was dependent—

I. On their individual capacity for protecting or improving the productive capacity of the soil,

II. On their relative demands with regard to light, and

III. On their relative rate of growth in height,—

the following rules for the formation of mixed forests were formulated by Heyer*:—

1. *The principal or ruling species must be capable of improving the soil.*—That is to say, the matrix should consist of species like beech, hornbeam, spruce, silver fir, Douglas fir, Austrian and Scots pine.

2. *Shade-bearing species may be grown in admixture with each other when their rate of growth is about equal, or when the slower-growing species is protected against the quicker-growing.*—The protective measure adoptable in the latter case consists of giving some start at first to the slower-growing species, of allowing it to form the great majority of the crop, or of favouring it at the time of natural reproduction, and later on by lopping, topping, or even cutting out the other species threatening to suppress it.

3. *Shade-bearing (thickly-foliaged) species can be intermixed with light-demanding (thinly-foliaged) species, when the latter are of more rapid growth in height, or when they are afforded some advantage as to age or height.*—If, however, the shade-bearing species is to be expected to develop vigorously, without being apt to be suppressed during the youthful period of growth, it must form the principal or ruling species numerically.

---

* *Op. cit.*, pages 45–57.

4. *Light-demanding species should not be permanently associated together as timber crops.*—When the slower-growing species is at the same time relatively the more capable of bearing shade (*e.g.* Austrian pine and larch), exceptions to this rule can be made—

(*a.*) On very good soil not exposed to deterioration under the light canopy of the thinly-foliaged species. Under such conditions mixed growth of alders and ash, oak and elm, &c., are not at all injudicious.

(*b.*) On very poor (sandy) soil, principally given up to conifers, where of broad-leaved species the birch alone is content to grow.

Except on soil and situations where the Scots pine shows a decided tendency towards a fuller degree of shade-bearing capacity than usual, a mixture of this species and larch is not at all advisable, although very often made in Britain (see pp. 28, 29).

5. *The subordinate species should be introduced individually, and not in patches or groups.*—Here, again, however, exceptions may be made—

(*a.*) When the quality of the soil is variable, so that patches here and there are specially suited for any one particular species (*e.g.* spruce on shallow, stony soil; ash and alder on damp, wet spots; pines on dry patches).

(*b.*) When a light-demanding species is to be grown along with a shade-bearing species of quicker growth (*e.g.* oaks grown in admixture with beech on soils specially favourable to the latter).

(*c.*) When standards (*e.g.* of oak) are retained for a second period of rotation. Here some protection is afforded to the soil until the young seedling crop forms canopy, and at the same time the formation of shoots from dormant buds along the stem, leading too often to "*stag-headedness,*" is prevented.

A.—CONCERNING MIXED CROPS OF SHADE-BEARING SPECIES.

Spruce and Silver Fir.—Where spruce forms the ruling species, the introduction of silver fir as part of the crop is of great advantage in diminishing the danger of windfall and of destructive attacks from injurious insects; but where the soil is good enough for the silver fir to form the bulk of the mature crop, any admixture of spruce has just the opposite effects. As in early youth spruce is the more rapid in growth, the silver fir should be introduced in considerably larger numbers than ultimately desired; thus, if originally planted in the proportion of two of silver fir to one of spruce, the mature crop would ultimately consist of about equal numbers of each species.

Beech and Spruce.—Although beech is of somewhat quicker growth at first, it soon gets caught up by the spruce, which then usually remains predominant. Unless the beech is to be ultimately suppressed, the spruce must only be scattered singly throughout the crop, and even then lopping of the branches will have to take place. Where stony outcrops occur in beech woods, it is best to form pure clumps of spruce.

Beech and Silver Fir.—At first the beech develops more rapidly and interferes with the growth of the silver fir, but later on this overtakes and threatens to suppress the former.

B.—CONCERNING MIXED CROPS OF SHADE-BEARING AND LIGHT-DEMANDING SPECIES.

Spruce as ruling Species or Matrix.

During the youthful period of development all light-demanding species of trees are of quicker growth than the spruce, and damage the latter by injuring the tender leading-shoots when it begins to catch them up in growth. Later on most of the light-demanding species are overtaken by the spruce, and unless it is intended to utilise them by removal during the periodical thinnings, the former require special tending and protection.

Spruce with Oak, Ash, Maple, Sycamore, or Elm as subordinate Species.—All these species are overtaken in growth by spruce between the 15th to 25th year as a rule, although on very good soils they retain their advantage somewhat longer, especially when they also predominate numerically. For the most part, however, these valuable species are grown in admixture with the beech. Even when oak has an advantage in growth up to about 20 years, it is still usually liable to be caught up when the spruce gets to about 50 years of age, and then is either suppressed or hindered in afterwards attaining its normal girth as mature timber. Experience shows that a mixture of oak with spruce should only take place when once the former has advanced considerably towards maturity. This can best be effected by cultivating the oak in pure forest first of all, and then about the 60th to 70th year making a strong thinning or partial clearance, with simultaneous sowing or planting of the spruce, the whole crop being harvested simultaneously about 80 to 100 years later,

Spruce and Birch.—Of all the subordinate species of trees which are at first of quicker growth than the spruce, the birch does most damage, owing to the extent to which the whip-like twigs scour and damage the leading-shoots. Thus, although useful as a nurse in localities exposed to frosts, an admixture of birch is not much favoured, more especially as, owing to its strong reproductive capacity from the stool, it is extremely difficult to get rid of it when no longer desired as part of the crop.

Aspen and Willow are also prejudicial to the development of the spruce, but not to the same extent as the birch.

Spruce with Scots Pine.—During the earliest period of development the quicker-growing pine affords the spruce beneficial protection against frost and heat; but the pine cannot exceed one-fifth to one-seventh of the crop without threatening to interfere for a long time with the normal growth of the spruce. Later on the pine, owing to the tendency to spread its crown, does more or less damage by rubbing and scouring the shoots of the spruce. On some situations the pine lags behind the spruce in growth between the 35th to 50th year, but then regains the lost ground on good soil, and continues till maturity among the dominating or predominating classes. In other localities observations have shown that on somewhat dry sandy soils the pine is of quicker growth throughout its whole period of development, whilst on fresh soils the spruce shoots permanently ahead when once it has caught the other up. A permanent mixture of these species is as a rule only recommendable on medium classes of soil, but by this means the pine can be made to hold out longer periods of rotation than otherwise and to develop into large-girthed stems of considerable marketable value.

Spruce with Larch.—This mixture is at first very similar to that of spruce and pine, but on soils suited to it the larch remains permanently predominant. Where, however, the soil is wanting in depth or mineral strength, and very frequently in low-lying localities, the larch is apt to be overtaken in growth in height by the spruce, and then it is hardly profitable to endeavour to retain the former so as ultimately to form part of the mature crop; it is better to cut it out at once.

Silver Fir as a ruling species closely resembles spruce, but is less active in suppressing the subordinate species when once it catches them up in growth, as its shade is somewhat less dense. The same will also most probably prove correct with regard to the *Douglas Fir*.

Austrian, Black or Corsican Pine can bear a considerable amount of shade, and improves the soil in no slight degree through its rich fall of needles; hence it is naturally adapted as a ruling species, more especially when grown along with the very lightly-foliaged species like larch.

Beech as ruling Species.

Beech with Oak.—In exposed localities and on shallow, especially on limy, soils oak is slower in growth than beech, although on most other soils and situations it is decidedly of more rapid development. But even in this latter case the advantage won is seldom so great as to obviate the necessity for adopting measures to protect it against the beech. This is in some cases effected by forming pure crops of oak first of all, and then underplanting them with beech either during the pole-forest stage of growth, or about the 70th to 90th year, when the main growth in height has been completed, a heavy thinning or partial clearance previously taking place in each case. Again in mature mixed crops the oak can be reproduced first in groups of 20 to 30 feet in diameter, or by planting up the blank patches in beech seedling-growth with strong oak transplants, by favouring the oak during all operations of thinning, and by stimulating it to increased growth in height through removal of the lower branches of the crown periodically, before they attain a diameter of over four inches.

On very good soil not apt to deteriorate under the loose canopy of the oak, this species can be introduced to such an extent as to far outnumber the beech; but on the less fertile and the merely average classes of forest soil considerations regarding the conservation of its productive capacity necessitate that each oak should be surrounded with beech. Where this is fully acted up to there will be seldom more than 8 to 10 oaks per acre attaining maturity at 100 to 120 years of age, though on the best classes of soil the number of oaks in the crop may perhaps amount to as many as 30 to 40 per acre. When the oaks have been introduced in too large number at first, an early commencement should be made to reduce them gradually to the proper proportion they are intended ultimately to form in the mature crop, by the removal of all stems of indifferent growth. If, in order to obtain very large-girthed timber, it seems desirable to allow the oaks to remain on good soil for a second period of rotation of the beech; they can be left in the numbers above given, but before the end of that time they will in the latter case have formed canopy, under which the beech may still grow up as a tree, though not so as to attain normal dimensions On average classes of soil 8 to 10 oaks per acre will at the end of the second period of rotation overshadow about one-fourth of the soil, and 16 to 20 about one-half of the area.

Beech with Ash, Maple, Sycamore, and Elm.—Despite a very considerable density of foliage in the sycamore under certain circumstances, all these species strongly resemble the oak in its attitude towards the beech, being all light-demanding and of quicker growth at first than the latter. This advantage they usually retain on deep, fresh soils; but otherwise they are as a rule caught up in growth by the beech during the pole-forest stage of development. In many situations they are apt to sow themselves so freely as materially to interfere with the natural reproduction of the ruling, soil-protecting species; hence it is advisable to utilise them at the time of preparing the soil for the reception of the beech-mast, and to introduce them here and there singly or in small patches throughout the new seedling crop. By the use of healthy transplants, and by selection of the most suitable patches for the growth of these various species, better results can be attained than by endeavouring to reproduce the whole crop as mixed forest. In addition to some advantage in age and height at first, careful tending of these more valuable species is requisite during all the operations of thinning. It is only on the soils best suited to their growth that these kinds of trees can hold out the usual period of rotation (90 to 120 years) best suited to the beech; hence by the time fixed for the fall of the mature crop they will in many cases have disappeared from the woods, having been removed for disposal when they had reached their full physical and economic maturity. The more the soil is suited for the beech, the earlier will the fall of these subordinate species be necessitated; but in any case the quantity and quality of the timber harvested will yield better returns than if attempts be made to grow them in pure forest without the beneficial assistance of the beech.

For moister classes of soil the *Hornbeam* can often yield better service than the beech. and as its growth is not so energetic there is less likelihood of its catching up the nobler species and threatening to suppress them. Although it yields much smaller returns in timber, the latter is, owing to its extreme toughness, valuable for machinery work; and as it attains its physical and economic maturity much earlier than the beech, it is in some respects even a more favourable ruling species than the latter,—that is, when it is desirable to allow the soil to remain as short a time as possible in the sole possession of the ruling species, for practically the natural reproduction of the hornbeam could take place immediately after the fall of the subordinate species.

Beech with Birch, Aspen, and Willow.—As a rule no artificial efforts are necessary to attain an admixture of the softwoods in seedling crops of beech ; in fact they sometimes occur self-sown to such an extent as to come under the heading of "*forest weeds,*" for the removal of which a considerable expenditure of time, trouble, and outlay is often necessitated. Where they occur singly and individually here and there, not only is no damage done by them, but they are often beneficial in protecting the slow-growing beech against late and early frosts ; and with favourable opportunity of disposing of small material they can be made to yield fair returns when cut out during the cultural operations of weeding and clearing. Wherever they occur in considerable numbers, however, they interfere considerably with the development of the beech, and must be cut out as soon as possible in order to avoid the formation of blanks. On account of their strong reproductive capacity and the rapidity of growth of their coppice-shoots and stoles, it is better merely to lop them and leave snags of two or three feet standing than to cut them flush with the ground. With the timely removal of the soft-wood nurses, a good opportunity is offered for the introduction of sturdy transplants of the nobler species of our forest trees. But when once the proper time for their clearance has been allowed to slip by, it is difficult to adopt any other measure than their gradual removal during the subsequent operations of tending, without at the same time exposing the principal crop to the danger of being bent down or laid ; for the young beech poles are apt to be drawn up so fast as to become top-heavy without the partial support of the softwoods.

Beech with Scots Pine.—Each of these species accommodates itself well to the peculiar requirements of the other, for the light-demanding pine is throughout all the stages of its development of more rapid growth than the beech. If introduced to a moderate extent only, pine does little damage to the latter by over-shadowing, whilst at the same time it acts beneficially as a nurse in protecting the beech from extremes of heat and cold. In such mixed crops the Scots pine attains more valuable dimensions and is of better quality than when grown either pure or in admixture with other conifers, and it can also be worked with a higher period of rotation without any financial loss.

It is a curious fact that, under the light shade of the pine, the natural reproduction of the beech can be more easily and successfully carried out than under the shelter of parent standards themselves.

As the natural habit of the Scots pine tends towards the early lateral development of the crown, it should not be given any advantage in age or height to begin with; its introduction can therefore easily take place by sowing or planting here and there throughout the young seedling crops of the ruling species.

The *Larch*, as a subordinate species in admixture with beech, on the whole closely resembles the Scots pine, except that it then often reaches its physical and economic maturity at about 50 to 60 years of age, and that it makes higher demands on the quality of the soil.

C.—CONCERNING MIXED CROPS OF LIGHT-DEMANDING SPECIES.

Considerations relative to the conservation of the productive capacity of the soil demand that under ordinary circumstances some shade-bearing species should form a portion of the crop, the true scientific principle being (as already above stated) that it should in fact form the major part of it, *i.e.* be the ruling species. But under certain special conditions of soil and situation it may seem desirable to the proprietor to depart from this principle and form mixed forests consisting entirely of light-demanding trees. Such crops must ultimately, from their natural habits of growth, fail to maintain close canopy; and unless the soil is possessed of such physical properties as render it little likely to deteriorate through insolation and the action of winds, the practical formation of a mixed crop is rendered advisable by means of underplanting with the shade-bearing species for which the soil is best suited. Where fresh to moist low-lying tracts with good soil are still under forest growth, mixed woods of oak with ash and elm, or with alder and birch, alder with ash, birch, and aspen, pines with aspen and alder, and the like, are often to be seen in flourishing growth and yielding good returns to the proprietors.

In Britain the light-demanding species which is most frequently to be found forming the ruling species or matrix is undoubtedly the Scots pine, but even in our damp insular climate the admixture with it of a species capable of bearing shade has a very beneficial effect on the soil, and through that on the quantity of timber obtained at the fall of the crop. For the better classes of pine soil the beech or silver fir, or on moist localities exposed to frosts the hornbeam and Douglas fir, and for average and inferior localities the spruce, Austrian (black or Corsican) and Weymouth pines are recommendable as subordinate species ; but as, on the inferior tracts classifiable as pine soil, these species are less tolerant of shade than elsewhere, they must receive a fair amount of consideration during all operations of tending and thinning. The admixture of larch with Scots pine on such localities betokens want of knowledge of the natural requirements of the larch in respect to fertility and depth of soil, whilst at the same time, owing to the more rapid growth of the larch, the pine suffers even from the light shade cast over it by the former.

RECAPITULATION.

To summarise briefly what has been said at length in the above in exposing the fallacy contained in Sir Herbert Maxwell's statement quoted at the beginning,—where only one species of tree has mainly to be taken into account each block of forest may have the advantage of being easier to work, both as regards tending, the fall of the mature timber, and the reproduction of the crop (though not necessarily, so far as the latter is concerned), but it is much more exposed to climatic dangers like extensive windfall over areas covered with spruce, or damage from snow and ice in pine tracts, or attacks of insect enemies as with both spruce and pine, or cankerous fungoid disease as in the case of larch or silver fir, &c.

Pure forests cripple and confine the management to one kind of timber practically in any one locality, and if the market for that particular kind goes down and becomes unremunerative, it is not easy all at once to pave the way for the production of other more profitable crops of timber.

It will in general, therefore, be to the advantage of the landowner to avoid the formation of pure forests over extensive areas. But occasionally it happens that there is little practical choice about the matter. The land may be too poor for mixed crops of oak, ash, maple, sycamore, elm, larch, &c. to grow along with beech, hornbeam, spruce, silver or Douglas firs, and then pine forests are the best that can be formed if the land is to be put under timber at all; or undrainable tracts may be better suited for alders or willows and poplars than for other species; or local requirements may be such that a fairly well-assured and constant future market for one particular class of timber seems to point to its cultivation as most advisable and attractive.

In most mixed crops of about equal age certain species, either through greater energy of growth in height, or in consequence of soil and situation specially favouring their development, or from a combination of both these factors, attain advantages in rate and extent of development which induce or necessitate a corresponding fall below the par of normal development in the other species; hence sooner or later these latter species, unless specially tended, have to be removed from the crop, even although they may not have attained their physical and technical maturity. It thus happens that in many cases mixed woods towards the end of the period fixed by the working-plan for the fall of the mature crop consist principally of one species, which is usually that most capable of bearing shade. But when this species has been either naturally or artificially reproduced, the most advantageous opportunities are again offered for the re-formation of mixed crops by the introduction of stout transplants of the more valuable timber-producing trees.

With their denser crops, their better conservation of the productive capacity of the soil, their higher percentage of stems of large dimensions, clean growth, and good technical properties, their power of satisfying demands for various kinds and qualities of timber, and their comparative security from calamities and devastations arising from organic or inorganic causes, it can hardly be denied that mixed forests are more profitable and rest on a much more secure financial basis than pure forests, provided always that they are formed of the species for which the soil and situation are best suited, and that the timber grown is such as suits the requirements of the ordinary markets. In fact, as compared with pure forests, mixed woods exhibit the economic paradox of holding out fair promises of a higher rate of annual interest, combined at the same time with better security for that very considerable portion of the capita which is represented by the growing stock of timber throughout the woodland area.

THE

CLIMATIC AND NATIONAL-ECONOMIC INFLUENCE OF FORESTS.

BY

JOHN NISBET, D.Oec.,

OF THE INDIAN FOREST SERVICE; AUTHOR OF "BRITISH FOREST TREES AND
THEIR SYLVICULTURAL CHARACTERISTICS AND TREATMENT," TRANSLATOR
OF KAUSCHINGER-FÜRST'S "PROTECTION OF WOODLANDS," ETC.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

1893.

TABLE OF CONTENTS.

THE CLIMATIC AND NATIONAL-ECONOMIC INFLUENCE OF FORESTS.

Page
1. As regards Atmospheric Temperature - - - - 3
2. As regards Soil Temperature - - - - - 7
3. As regards the Degree of Atmospheric Humidity - - - 8
4. As regards the Precipitation of Aqueous Vapour - - 10
5. As regards Evaporation of Soil-Moisture - - - - 13
6. As regards the Feeding of Streams, and the Protection of the Soil - 15
7. As regards General Hygienic Effect on the Atmosphere - - 16
8. As regards the Agricultural Productive Capacity of Neighbouring Tracts, and the National-Economic Effect on the Soil generally - - 19

THE

CLIMATIC AND NATIONAL-ECONOMIC INFLUENCE OF FORESTS.

[LITERATURE.—Ebermayer, *Die physikalischen Eigenschaften des Waldes auf Luft und Boden*, 1873, *Die Beschaffenheit der Waldluft*, 1885, *Hygienische Bedeutung der Waldluft und des Waldbodens*, 1890; Mathieu (1878), and Bartet (1890), *Météorologie comparée, agricole et forestière*; Weber, *Die Aufgaben der Forstwirthschaft* (Vol. I. of Lorey's *Handbuch der Forstwissenschaft*, 1886); v. Libernau, *Resultate forstlich-meteorologischer Beobachtungen*, 1890; Wollny, *Forschungen auf dem Gebiete der Agrikulturphysik*, Vol. V. *et. seq.*; Müttrich, *Jahresbericht über die Beobachtungsergebnisse der forstlich-meteorologischen Stationen*, published annually for last 18 years; Endres, Articles on *Forsten* (Vol. III. of *Handwörterbuch der Staatswissenschaften*, Jena, 1892); Fernow, *Forest Influences*, Washington, U.S.A., 1893.

The statistical data given in the following pages have, with his kind permission, been mainly taken from Prof. R. Weber's excellent classification of the results arrived at up till 1886. Since that date no similarly complete classification including the more recent data has yet been published.]

IT was not until the year 1867 that exact scientific observations were undertaken on any extensive scale to determine the actual influence which forests have in modifying the temperature of the air and of the soil within their own areas and over the surrounding tracts of country. The first results were published by Professor Ebermayer in 1873 in his celebrated work, "*Die Physikalischen Einwirkungen des Waldes auf Luft und Boden.*"

1. *As regards Atmospheric Temperature.*—From observations recorded between 47½° and 49½° latitude, averaging 540 métres (1,800 ft.) above sea-level, and with a mean distance of 900 métres (3,000 ft.) between the edge of the forest and the stations in the open, Ebermayer found the *mean annual atmospheric temperature* to be cooler in the forest than in the open by—

At 5 ft. above the soil - - -	1·74° Fahr.
In the tree crown - - - -	0·66° „

He also recorded the temperature of the trees themselves, and found that they were invariably cooler than the atmosphere surrounding them during the active period of vegetation, whilst they were *occasionally* a little warmer during the winter period of inactivity.

Ebermayer's observations during the year 1868–69 yielded the following average results:—

Trees themselves cooler than the air surrounding them by

In Degrees Fahr.	Spring.	Summer.	Autumn.	Winter.	Annual Average.
At 5 ft. above the ground.	2·26°	3·15°	1·19°	2·28°	2·21°
In the tree crown	1·48°	2·11°	0·67°	0·72°	1·24°

Reckoned separately for each season of the year, the average results of observations made during 10 years (1875–85) throughout nearly the whole of Germany, and in parts of France and Switzerland, in different kinds of forest, at heights above the sea-level varying from 10 to 3,000 feet, and at latitudes varying from 47½° to 55¼°, prove conclusively that in general the mean atmospheric temperature in forests is cooler than in the open, as exhibited in the following abstract:—

Temperature of Woodland Air compared with that of Air in the Open.

In Degrees Fahr.	At 5 ft. above the Ground.	In the Tree Crown.
Spring	1·24° cooler	0·57° cooler.
Summer	2·55° "	1·47° "
Autumn	1·13° "	0·41° "
Winter	0·61° "	0·08° warmer.
Annual Average of all recorded observations	1·044° cooler	0·414° cooler.

That is to say, the annual average temperature within forests growing in closed canopy is lower than in the open, although the crowns of the trees are on the whole a little warmer in winter. The difference is greatest in summer, least in winter, and about midway between these extremes in spring and autumn; the mean annual difference, however, seldom amounts to over 1° Fahr. near the ground, and is scarcely ½° in the crowns. The prevention of insolation of the soil during the long hot days of summer, and the rapid transpiration taking place through the foliage, exert a greater influence on the atmospheric temperature than can be ascribed to shelter from wind and to decrease of nocturnal radiation.

The Swiss observations recorded at three stations during the 12 years 1869–80 gave the following average results relative to the temperature of closed forests at 10 ft. above the ground, and of the tree stems themselves at 5 ft. above the ground, as compared with the atmospheric temperature in the open at 10 ft. above the ground :—

Compared with the Atmospheric Temperature in the Open at 10 ft. above the Ground,

In Degrees Fahr.	That in closed Forests, and at the same Height,	That of the Tree Stems at 5 ft. above the Ground				
		In Forests of	Larch.	Spruce.	Beech.	On Average.
Spring	Was cooler by 1·32°	Was cooler by	3·60°	6·17°	2·74°	4·17°
Summer	„ „ 2·72°	„ „	6·01°	7·31°	5·72°	6·35°
Autumn	„ „ 1·56°	„ „	1·73°	4·05°	2·72°	2·83°
Winter	„ „ 0·91°	„ „	0·49°	1·71°	0·54°	0·91°

During the winters of 1870–71 the spruce trees were *slightly* warmer, and in those of 1869–70–71 the beech stems were from 1·35° to 2·09° Fahr. warmer than the air in the open. These observations prove (1) that the variations between the temperatures of the trees themselves and the air in the open exceed those between the woodland air and the latter except during winter, (2) that they are largest during the most active period of vegetation in summer, and (3) that they are greater in spring, when the circulation of sap begins, than during the autumn months, when vitality becomes sluggish and dormant.

In the crown of the trees, where insolation by day and radiation by night make their full influence felt, the difference in the daily average over the whole year is less than it is near the ground. In winter it averages little either above or below 0°, and in summer usually about the half of the reading at 5 ft. above the ground.

Observations made in Southern Germany establish the fact that in the forests it is cooler during the day and warmer during the night than in the open.

Atmospheric Temperature in the Forest compared with that in the Open.

Season.	Minimum at Night.	Maximum in Day.
	Warmer in Forest by	Cooler in Forest by
Spring	0·81° Fahr.	3·87° Fahr.
Summer	3·15° „	7·41° „
Autumn	2·59° „	3·97° „
Winter	0·95° „	1·96° „
Annual Average	1·87° Fahr.	4·30° Fahr.

During the night the trees interfere with the radiation of heat, and in the day-time the shade afforded by the crowns keeps the air from being rapidly warmed by the sun's rays. These influences are naturally strongest during spring, summer, and autumn, when foliage is most abundant, whilst in winter the coniferous forests with evergreen foliage are milder than deciduous forests.

Owing to these differences in temperature, beneficial currents of air are induced between the forests and the open country, which follow the same law as obtains in regard to land and sea breezes. During the day the cooler and moister air of the forest sets outwards to take the place of the heated air ascending in the open; at night the current sets in from the open, cooled by radiation, towards the forest.

The foregoing statistics prove that the immediate action of forests is to modify the daily maxima and minima of atmospheric temperature, whence it may be deduced that a comparison of the absolute extremes of temperature during the year must exhibit definitely the sum total of the influence exerted by forests on the temperature of the atmosphere. This modification of the extremes of temperature, which are bad alike for man and beast, and also for agricultural operations, is of immense importance from a national-economic point of view, since many places that were once fertile are now little better than barren wastes in consequence of the reckless denudation of forest (see pp. 19–22). The observations made in Prussia and Bavaria give the following important results:—

Average Difference of Temperature in the Forest and in the Open at 5 ft. above the Ground.	
Exhibited by Maxima of July.	Exhibited by Minima of January.
6·82° Fahr. cooler in forest	2·05° Fahr. warmer in forest.

In registering the data yielding these abstract results, it was observed that the geographical position, and the exposure of the forests to winds, exerted a certain amount of modifying influence in lessening the differences, and there are reasons to believe that towards the crown the forest temperature in winter is considerably higher than down nearer the ground. It was found, too, that certain forest trees exerted greater influence than others in consequence of the density of their foliage ; thus :—

Average Difference of Temperature in the Forest and in the Open.

In Forests of	Exhibited by Maxima of July.	Exhibited by Minima of January.
Beech - -	8·37° Fahr. cooler in forest	2·12° Fahr. warmer in forest
Spruce - -	4·61° „ „ „	4·28° „ „ „
Scots pine - -	4·14° „ „ „	2·12° „ „ „

The natural deduction to be drawn from these figures is that beech forests in summer exert, through their dense foliage and complete canopy, a considerably greater influence in diminishing the extremes of temperature than forests of spruce or Scots pine, but that after defoliation their influence is similar to that of the pine forest, and only half so great as that of the more densely foliaged spruce.

2. *As regards Soil-Temperature.*—The influence exerted on the soil-temperature by forests growing in close canopy is of considerable importance, especially with regard to the soil-moisture. Observations in Bavaria and Würtemberg gave the following results :—

Average Soil Temperature in the Forest compared with that in the Open.

In Degs. Fahr.	At Surface.	At 1 ft. Depth.	At 2 ft. Depth.	At 3 ft. Depth.	At 4 ft. Depth.
Spring - -	4·08° cooler	3·08° cooler	3·26° cooler	2·79° cooler	2·32° cooler.
Summer -	6·10° „	6·71° „	7·07° „	6·86° „	6·53° „
Autumn - -	1·85° „	2·16° „	3·04° „	3·26° „	3·58° „
Winter -	0·23° „	0·43° warmer	0·45° „	0·22° „	0·34° „
Annual Average	3·06° cooler	2·88° cooler	3·46° cooler	3·28° cooler	3·19° cooler.

It seems clear, therefore, that the mean annual temperature of the soil in the forest is at all the above depths of observation cooler than in the open, and that the differences are greatest in summer, about the mean in spring and autumn, and very small in winter. In countries with warm summers this reduction of the soil-temperature over large areas by means of forest growth has a decidedly beneficial result. According to observations made in Würtemberg the difference between the maxima of soil-temperature in forests and in the open can extend so far as up to 14° Fahr.

Ebermayer found that the daily differences in soil-temperature varied according to the season of the year, but that throughout nearly the whole year the upper layers of soil in the open were warmer in the afternoon than in the forenoon, whereas in the forest the variations were inconsiderable.

As in the case of the atmospheric temperature, the influence of the forest trees in equalising the soil-temperature throughout the year is greatest in the case of trees whose foliage is densest, spruce heading the list.

3. *As regards the Degree of Atmospheric Humidity.*

"Aqueous vapour* is contained in the air in quantities varying in different localities and at different times, and depending mainly upon the temperature of the air. Air at a given temperature cannot contain more than a certain quantity of moisture in solution; and when it has taken up this maximum quantity, it is said to be saturated with aqueous vapour. The higher the temperature of the air, the more water can it retain as vapour; and when air saturated with moisture is cooled, the water is deposited in the liquid form in very small globules, forming a mist, fog, or cloud. This is the cause of the fall of rain, snow, and hail; when warm air heavily laden with moisture from the ocean passes into a higher and colder position, or meets with a current of air of lower temperature, it cannot any longer retain so much aqueous vapour, and a large quantity assumes the liquid form, falling as rain when the temperature is above the freezing-point, or crystallising as snow-flakes if the temperature be below that point. Hail is caused by the congelation of rain-drops in passing through a stratum of air below the freezing-point. The quantity of rain thus deposited is very large; 1 cubic métre of air saturated with moisture at 25° C. contains 22·5 grams of water, and if the temperature of this air be reduced to 0° C. it will then be capable of retaining only 5·4 grams of water vapour; hence 17·1 grams of water will be deposited as rain. The air in England is often saturated with vapour, whilst the driest air observed on the coast of the Red Sea during a simoon contained only one-fifteenth of the saturating quantity. . . . . In general the air contains from 50 to 70 per cent. of the quantity necessary to saturate it. If the quantity be not within these limits, the air is either unpleasantly dry or moist."

By means of experiments the maximum tension and density of the aqueous vapour has been fixed for every degree of temperature, and this limit denotes the *point of saturation of the air*. As air and aqueous vapour exert no pressure on each other, barometric readings offer a ready and easy means of estimating the absolute quantity of aqueous vapour held in solution by the air, *i.e., its absolute humidity. The relative humidity* of the atmosphere is ascertained by comparing the absolute humidity with the possible maximum for the same degree of temperature, and expressing the comparison in its percentage of the latter.

Observations throughout Middle Germany show that *as regards the absolute humidity of the air* forests have no appreciable climatic effect. The annual average showed merely the following traces of differences at 5 feet above the soil:—

---

* Roscoe's "*Elementary Chemistry*," 1888, pp. 51 and 52.

In Forest of	Barometric Pressure in Millimetres.
Beech - - -	0·06 less than in the open.
Spruce - - -	0·00, same as in the open.
Scots pine - -	0·14 more than in the open.

The differences between the relative humidity of the air in forests and in the open are, as might be expected, greatest in summer. Observations conducted in Switzerland during 12 years showed the following results:—

At 5 feet above the Ground.	Relative Humidity of Air greater in the Forest than in the open by
Spring - - -	4·89 per cent. of saturation.
Summer - - -	9·14 „ „
Autumn - - -	6·81 „ „
Winter - -	2·68 „ „
Annual Average -	5·88 per cent. of saturation.

In Bavaria, again, the differences varied from 5·22 to 9·28 per cent., with an average of 6·36 per cent. for the year, and it must be noted that very different results are obtained with changes of altitude and of other physical conditions. Thus the above-quoted Swiss observations showed the following differences as regards species of forest trees:—

Relative Humidity of Woodland Air at 5 feet above the Soil compared with that in the Open, and expressed in percentage of Saturation.

Season.	Larch.	Spruce.	Beech.	Average.
Spring - -	2·83 more	9·59 more	2·26 more	4·89 more.
Summer - -	7·85 „	11·04 „	8·53 „	9·14 „
Autumn - - -	5·45 „	10·79 „	4·18 „	6·81 „
Winter - -	0·34 „	8·40 „	0·70 less	2·68 „
Annual Average -	4·12 more	9·96 more	3·56 more	5·88 more.

The Prussian observations for 1884–85 showed that the differences were less in the tree-crowns than at 5 feet above the ground, as thus tabulated :—

Relative Humidity of Woodland Air compared with that of the Open, in percentage of Saturation.

In Forest of		Spring.	Summer.	Autumn.	Winter.	Annual Average.
Beech	at 5 feet above the ground.	0·3 more	8·7 more	4·5 more	1·5 more	3·8 more.
	in the tree crown .	0·3 „	6·8 „	3·5 „	0·8 „	2·8 „
Spruce	at 5 feet above the ground.	6·0 more	7·2 more	5·4 more	3·2 more	5·4 more.
	in the tree crown .	2·2 „	3·6 „	2·4 „	1·0 „	2·3 „
Scots pine	at 5 feet above the ground.	2·8 more	4·4 more	4·4 more	2·4 more	3·5 more.
	in the tree crown .	0·2 „	0·0 „	2·2 „	2·5 „	1·3 „

Taken altogether, these results show that the mean annual relative humidity of woodland air is from 3½ to 10 per cent. greater than that of air in the open, but that the difference varies greatly according to the season of the year, being greatest in summer and autumn, and least in winter and spring. They show, too, that large areas covered with spruce will be moister, as well as cooler, than those under woods less densely foliaged. In Bavaria it was found that in summer, in consequence of the density of the foliage in beech forests during the most active period of growth, the difference even amounted to 13·6 per cent. of saturation over the relative humidity in the open. According to its relative humidity air is classified as—

Very dry, with less than 55 per cent. of saturation.
Moderately dry, with from 56–70 „ „
Moderately moist, „ 71–85 „ „
Very moist, with over 85 per cent. of saturation.

4. *As regards the Precipitation of Aqueous Vapour.*—It has been shown above, not only that the atmosphere within the forest is cooler than in the open, but also that the temperature of the trees themselves is lower, especially in summer, than the air surrounding them; hence, when a current of air is wafted from the open into the forest, and comes in contact with the cooler trees, its temperature is reduced, and it is brought nearer to the point of saturation, *i.e.*, its relative humidity increases. But if this air was already in the open at or near the point of saturation, then the effect of the cooling process is that a certain amount of surplus moisture beyond the aqueous vapour that

can be held by the air up to the point of saturation at its reduced temperature must be released and precipitated in the form of dew. Woodlands therefore act as condensers of atmospheric moisture, and decrease the absolute humidity of the air whilst increasing its relative humidity; and in addition to this, they add to the humidity of the air by transpiration from the leaves, whilst the sap is being made available for structural purposes, and the work of assimilation is proceeding.

Endeavours have been made to establish, by means of careful observations, the effect of forests in regard to the precipitation of aqueous vapour in the form of dew or rain, but the results are often of so conflicting a nature that, up till the present, safe deductions cannot be drawn. In order to compare observations made in the forests with those made at the usual meteorological stations in the open, a correction would in each case be necessary to reduce the localities to the same sea-level, as air cools in rising and increases in relative humidity, *i.e.*, it approaches the point at which it must precipitate some of the aqueous vapour held by it. Hence rainfall generally increases with the height of a locality above the sea-level, although no direct proportional increase can be proved. It fluctuates with the geographical position and the varying physical conditions of each point of observation, whilst variations in the direction of the moist winds of the locality also militate against the collection of reliable data for comparison with readings made in other localities.

The mean of the readings at 192 points of observation in Germany, corrected as carefully as possible with reference to these causes of difference, are thus exhibited by Weber:—

Height above Sea-level.	Up to 333 feet.	333 to 666 feet.	999 to 1,333 feet.	2,000 to 2,333 feet.	2,333 to 2,666 feet.	3,000 to 3,333 feet.
Inches of rainfall in forest.	26·24	26·60	29·84	43·56	56·32	71·00
Inches of rainfall in open.	25·92	23·28	27·84	36·60	39·24	38·54
Inches of excess in forest.	0·32	3·32	2·00	6·96	17·08	32·46
Percentage of excess rainfall in forest over that in the open	1·25	14·3	7·1	19·0	43·7	84·2

No inference seems capable of being drawn from these statistics, except that at high altitudes large extents of forest may considerably increase the local rainfall. As regards the quantity of rainfall and snowfall which is intercepted in forests by the leaves, branches, and stems of the trees, the observations made in Switzerland, Prussia, and Bavaria give the following results :—

Species of Forest.	Of every 100 inches of Rainfall in the Forest,	
	There reached the Soil.	Were intercepted by Trees.
Beech - - -	81	19
Spruce - - -	76	24
Scots pine - -	70	30
Larch - - -	85	15
Average - -	78	22

That is to say, nearly one-fourth of all the precipitations of aqueous vapour is intercepted by the forest trees, and is given off again by evaporation, or is gradually conducted down the stems to the soil. In lofty forest-clad regions the mechanical action of the rains on the surface-soil is thus very much modified.

By means of their lower temperature, their greater relative humidity, and the mechanical obstruction they offer to the movements of currents of air, extensive forests act decidedly as condensers of the aqueous vapour contained in the atmosphere, and their influence in this respect is more marked at high altitudes and in mountainous districts than on plains or near the sea-coast, where other physical factors come into competition with and modify it. Further data are still requisite to enable us to determine with anything like certainty that forests directly cause increase of precipitations irrespective of such local considerations as the ruling direction of winds and peculiarities of situation; the generally accepted dictum is, however, that in the vicinity of extensive forests rainfall is greater than at other localities under otherwise similar physical conditions.

Col. A. T. Fraser, R.E., of the D.P.W. of India, in an article on "*The Improvement of Land*," thus recently expressed himself* :—

> "It is now generally recognised that the precipitation of rain is largely determined by electrical causes, easily proved by a well-known lecture-room experiment. During fine weather the potential of the air is found to be positive, and only changes to negative during broken or rainy weather. The earth's surface, on the other hand, if overspread with vegetation, or cultivated, is usually in the negative electric state. On occasions of heavy rainfall there are always two layers of cloud; one at a great elevation in the sky, the other a low bank of driving clouds much closer to earth, containing the rain, and sharing the electrical state of the air. Whenever thes

---

* See "*Indian Engineer*" for April 1892.

clouds reach places in a negative electrical condition, the particles of moisture present are attracted to earth, descending as rain. But an expanse of water, such as the sea, has, unlike the cultivated land, positive potentiality, and shares together with sandy deserts and all dry surfaces a tendency to repel showers. *Besides therefore imparting the requisite electro-negative condition to the ground, plantations cool the air, and the trees are always wrapt in an atmosphere of humidity, while evaporation is checked.*"

In portions of the Russian Steppes, planted up nearly 50 years ago, the inhabitants assert that the summer rainfall has considerably increased, and that the danger to crops from drought is not so great as formerly, whilst the villages are also protected by the forest from the violence of the winter storms.

In summarising and criticising this point Professor Endres of Karlsruhe remarks as follows* :—

"The data furnished from tropical countries must be accepted with the greatest caution, and in any case they afford no conclusive deductions for European circumstances. Blandford reports from India (*Meteorological Journal*, 1888) that in an area of 61,000 square miles, which was formerly denuded of woodlands, but has been planted up again from 1875, the rainfall has increased 12 per cent. since then. But H. Gannet (*Weather*, 5th Vol.) arrives at exactly the opposite conclusions for America, as his observations in the prairie region and in Ohio go to prove that the re-wooding of a tract exerts no perceptible difference on the amount of the aqueous precipitations. Lendenfeld also tries to prove that the clearance of woodlands in Australia has resulted in a better climate and an increase in rainfall, as the soil under eucalyptus remains hard as stone and inabsorptive, whilst it is rendered lighter and more porous by grass ('*Petermann's Geog. Mittheilungen*,' Vol. 34.)"

5. *As regards Evaporation of Soil-Moisture.*—The low temperature and the high relative humidity of the atmosphere in forests are unfavourable to rapid evaporation, which is still further reduced by the protection afforded to the soil against direct insolation and the action of winds. From observations extending over 10 years (1876–85) in various parts of Germany and Austria, the following relation is shown between evaporation in the forests and in the open in the vicinity of the forests; the differences would probably be greater if comparisons had been made with places in the open that were far removed from the modifying influence of the woodlands :—

	Water evaporated.	
In the open - -	20·9 inches	The practical importance of this will be seen, when it is recollected that the mineral food in the soil can be taken up by the rootlets only when in the form of *soluble* salts.
In the forest - -	9·5 "	
Lower in forest than in open by	11·4 inches	
Evaporation in forest expressed in percentage of that in the open - -	46 per cent.	

---

* Conrad, Elster, Lexis, and Loening's "*Handwörterbuch der Staatswissenschaften*," 1892, Vol. III. page 608.

It was also found that the amount of evaporation depended on the class of forest, thus:—

Species of Woodland.	Percentage of Water.	
	Evaporated in the Forest.	Remaining in the Soil.
Beech - - - - - -	40	60
Spruce - - - - - -	45	55
Scots pine - - - - -	42	58
Clearing for reproduction - - - -	90	10

In these statistics no account has been taken of the quantity of water given to the air by transpiration through the leaves; but this is not of essential importance, as such supplies of moisture are drawn by trees, except during the earliest stages of growth, from the deeper layers of soil and subsoil not immediately and directly affected by the aqueous precipitations on the surface. This may be less true of spruce than of other trees.

The action of forests, therefore, is to retain in the soil a large proportion of the rainfall or of the moisture arising from the melting of snows, which, by percolation to the lower layers and the subsoil, tends to feed the streams perennially, and to maintain a constant supply of moisture, without which trees could not derive their requisite food-supplies from the soil.

Arranged for convenient comparison with the data given on page 11, the following relation is shown between the aqueous precipitations and their evaporation:—

Height above Sea-level.	Excess of Precipitations over Evaporations.		Percentage of Evaporations to Precipitations.	
	In the Open.	In the Forest.	In the Open.	In the Forest.
Up to 333 feet -	12·2 inches	12·5 inches	55	37
333 to 666 feet -	12·9 "	14·0 "	53	30
999 to 1,333 feet -	12·4 "	17·9 "	58	25
2,000 to 2,333 feet -	37·5 "	31·8 "	22	13
2,333 to 2,666 feet -	47·8 "	43·7 "	15	9
3,000 to 3,333 feet -	57·7 "	47·0 "	19	11

The excess of rainfall over evaporation increases therefore with altitude, though not in any direct proportion; and in forests in mountainous tracts, at an elevation of 2,500 to 3,000 feet, about 90 per cent. of the rainfall remains in the soil, whilst only about 10 per cent. is evaporated.

The nature of the soil-covering below the forest trees exerts also considerable influence on the amount of moisture evaporated. From experiments conducted during five years in Bavaria it was found* that the following relation existed:—

Soil in Forest.	Percentage of Evaporation in Forest to total Precipitations in the Open.
Without good covering of fallen leaves and humus.	47
With good covering of fallen leaves and humus.	22

This shows that a good layer of fallen leaves, and of *humus* or vegetable mould formed by their decay, is a powerful factor; it diminishes the evaporation by more than half, or reduces it to less than one quarter of that in the open, and thus adds very considerably to the surplus amount of moisture retained in the soil.

6. *As regards the Feeding of Streams and the Protection of the Soil.*—From the above data it seems evident that the effect of extensive forests, more especially of those situated at high altitudes, is, by cooling the air and reducing its capacity for retaining aqueous vapour, to increase the precipitations. Whilst these precipitations are taking place the crowns of the trees intercept a large proportion of the total, and by breaking the violence of the rainfall protect the soil from the danger of being washed away during heavy storms. By the decomposition of fallen leaves and twigs a strongly hygroscopic soil-covering is formed, capable of imbibing and retaining moisture with sponge-like capacity. Rapid evaporation of the soil-moisture is counteracted through the protection afforded by the foliage against direct insolation during the day, and by the mechanical hindrance offered to currents of wind. The crown of foliage likewise prevents the soil cooling rapidly at night by radiation. The hotter the summer, the more marked are these beneficial effects of the woodlands. When, therefore, large tracts of country are denuded of timber, increase of temperature during the days of summer, rapid radiation of soil-warmth by night, diminished precipitations (especially in the spring and summer), and unchecked evaporation of moisture, due to complete insolation of the soil by day and absence of any protection from winds, must be the inevitable consequences. Examples of such actual results can be pointed out in many parts of continental Europe,

---

* Ebermayer's "*Gesammte Lehre der Waldstreu*," 1876, p. 182.

in Western Asia, and throughout India (see pp. 19–22). In Great Britain and Ireland the effects of the wholesale clearance of woodlands have not been so marked, in consequence of the favourable influences exerted on our climate by the Gulf Stream.

In localities having no protective woodlands heavy rains wash away the surface-soil, torrents and freshets rush down the water-courses with great violence, laden with detritus and discoloured with the soil held in mechanical solution, whilst streams and rivers often overflow their banks in consequence, devastating large areas of low-lying tracts under cultivation. Forests, on the other hand, tend to break the violence of the rainfall, and retain for the time being about one-fourth of the total amount on the foliage and branches; the roots of the trees and of the undergrowth help to bind the soil firmly; the rainfall is retained by the vegetable mould and by the spongy growth usually found on the surface-soil, and thence gradually percolates to the deeper layers, where it is held in reserve, to be finally parted with in being utilised for the feeding of perennial streams having their sources on the wooded slopes.

Thus arose in the Alpine districts of Southern Europe the necessity for maintaining "*ban-forests*" as a protection against landslips, avalanches, &c., and legal measures were early adopted for safeguarding them in order to protect the lower tracts from erosion of the soil when sodden with rainfall or melted snow.

7. *As regards General Hygienic Effect on the Atmosphere.*—It is well known that on the one hand when large tracts of forest are cleared for cultivation, especially in tropical and sub-tropical countries, fever and ague are frequently the consequence, and on the other that the planting up of notorious fever districts, such as the Campagna di Roma, the Tuscan marshes, and the Russian Steppes, has decidedly diminished the insalubrity of these localities. But the causes are very probably rather due to the degree of direct insolation of the soil, freely afforded in the one case, and counteracted in the other, than to any hygienic property inherent in tree-growth. In the latter case, too, stagnating surplus of soil-moisture may have been got rid of by transpiration through the foliage, and this would of itself go far towards removing causes of insalubrity, and improving the climate.

It is generally accepted that ozone kills miasma in the air, and purifies it,—at any rate impure air contains little or no ozone; the proportion of ozone is therefore usually taken as the measure of atmospheric quality. The belief that the woodland air is, like sea air, very rich in ozone has not yet been satisfactorily proved. Ebermayer's experiments in Bavaria showed that in the forests the percentage of ozone, though greater than that in the towns of Aschaffenburg, Leipzig, and Zwickau, was slightly less than in the open in the vicinity of forests, and that there was no perceptible difference in this respect between coniferous and deciduous forests.

The deductions he drew from his observations were as follows* :—

> "In the open the air is richest in ozone in the vicinity of lakes and in localities with high relative humidity; at high elevations (in mountains) it is in general greater than in low-lying tracts. The air in the forest, and in the open in its vicinity, is richer in ozone than that in districts further distant from the woods. But in the interior of the woods the quantity of ozone was not greater; on the contrary, it was somewhat smaller than in the open in the immediate neighbourhood of the forests."

The woodland air was found to contain most ozone in winter, which shows that its production could not be due to any chemical action of the foliage, for there are no leaves on deciduous trees at that season, whilst conifers transpire merely, and do not assimilate. It also indicates that the excess is probably due to the comparative freedom of air in the forest from the smoke, carbonic acid, and many other impurities with which air in the vicinity of towns is contaminated and defiled, and to the withdrawal of enormous supplies of oxygen from the air which takes place for the support of animal life at all populous centres. Thus whilst in general the quantity of carbonic acid in the atmosphere is somewhat under four volumes in 10,000, that is the normal amount in London air; but in thick fogs this proportion is frequently doubled, and has been known to be more than trebled, or even to exceed 14 volumes in the city.

Sunlight, however, has the power of decomposing carbonic acid in the presence of chlorophyll, the green colouring matter contained in foliage, the carbon being absorbed by the plant for its growth, and the oxygen set free. During darkness a contrary action takes place, oxygen being consumed by the foliage, and carbonic acid given off. As, however, particularly in the case of deciduous trees which are in leaf only from April till October, the hours of light far exceed in number those of darkness, the general hygienic effect of trees in cities and towns—apart from their invaluable æsthetic influence—tends decidedly towards the purification of the atmosphere from excess of carbonic acid.

Ozone again is, according to Roscoe, an allotropic modification of oxygen obtainable by passing a series of electrical discharges through it; hence it is more than probable that in forests in exposed localities, more especially those at high altitudes, where storms and electrical disturbances of the air are most frequent, a greater quantity of ozone must be generated in the atmosphere than in localities less subject to such powerful ozonising influences.

---

* "*Die Physicalischen Eigenschaften des Waldes auf Luft und Boden,*" 1873, Vol. I., page 242.

In one of his more recent publications Ebermayer, undoubtedly the greatest authority on this subject, says*:—

> "In the middle of the great 'ozone-factory,' which we must consider the forest to be, neither more oxygen nor less carbonic acid is offered to mankind for breathing than over large unwooded areas."

At another part of the same article he also adds†:—

> "From the hygienic standpoint it is worthy of notice that, according to my examinations, the air in and immediately above the crowns, then that in the immediate vicinity of the forests, has more ozone than that in the interior of the forests, where a portion of the ozone is consumed by the decomposing foliage lying on the ground."

It appears, therefore, to be his matured opinion at present that whilst more ozone is found in forests than in the open—which the Austrian students of the subject deny, or at any rate are not yet prepared to admit without further observations and proofs—yet the decomposing matter covering the soil consumes the surplus, and often more than that, so that no difference can be established in favour of the forest air. *In this withdrawal of ozone in excessive quantities from the air by decomposing vegetable matter the unhealthiness of tropical jungles, and the prevalence of malaria at all the lower elevations within the tropics usually covered by woodlands, seem to me easily explainable.*

According to Endres and to Fernow ("*Forest Influences,*" 1893), it is claimed that forests tend to resist the spread of epidemics, and to offer a bar to the progress of diseases like cholera and yellow fever. Fortunately there are not many infectious diseases the germs of which can be carried by water; as yet only two are known with certainty, cholera and enteric fever. When outbreaks of these diseases occur in tropical countries, the infectious power of the germs is favoured by warmth and moisture; moreover, when epidemic, these diseases usually break out in thickly populated towns and similar localities, where it is impossible to submit the soil-moisture or the water-supply to the filtrating action of belts of woodland.

---

* "*Hygienische Bedeutung der Waldluft und des Waldbodens*" in Vol. XIII. of "*Forschungen auf dem Gebiete der Agricultur-Physik,*" edited by Professor Wollny, 1890, page 429.

† *Op. cit.*, page 435.

8. *As regards the Agricultural Productive Capacity of Neighbouring Tracts, and the National-Economic Effect on the Soil generally.*—From an agricultural standpoint, a dry season is much preferable to a low temperature and excessive rainfall. In the former case the fruits of the earth, although they may be somewhat scanty, are invariably of superior quality. A wet season may produce abundant crops, but they are generally of low quality.

With regard to the influence of forests on the aqueous precipitations throughout central Europe, Prof. Endres makes the following remarks* :—

> "The question whether woodlands can influence the rainfall is one of the most important from a national-economic point of view. Even if this could be distinctly affirmed, the beneficial action of forests would only be established in the rarest cases, for throughout central Europe at present the number of too wet years exceeds that of dry years. *In districts where the rainfall is over* 40 *inches, any increase is undesirable.* For agriculture very dry years are on the whole less disastrous than extremely wet years. The precipitations of any district are influenced mainly by the position of the mountain ranges with reference to the cardinal points of the compass, by its elevation above sea-level, and its distance from the sea."

Even so early as in Roman times it was recognised that too great a clearance of woodland areas brought undesirable changes in the physical conditions of Italy, and affected the welfare of the inhabitants. That the destruction of the ancient forests throughout Great Britain and Ireland, to such an extent that only 3·8 per cent. of the total area can now be classified as woodlands (*vide* Parliamentary Report on *Forestry* dated 5th August 1887), was not followed by such disastrous climatic changes as were occasioned by similar causes throughout the Landes, Syria, Asia Minor, Greece, Russia, and many parts of India, we owe entirely to our insular position with its moist climate, and to the happy effects wrought by that portion of the Gulf Stream which reaches our western and southern shores.

Early in the present century, for example, the Agricultural Society of Marseilles reported that in consequence of the reckless destruction of the forests after the revolution of 1789 :—

> "The winters are colder, the summers hotter, and the beneficial spring and autumn showers no longer fall ; the Uveaune, flowing from east to west, rushes down in flood with the least rain, carrying away its banks and flooding the richest pasturage, while, for nine months of the year, its bed lies dry owing to the drying-up of the streams."

---

* *Op. cit.*, p. 607.

To a similar cause also Professor Geffcken (in "*The Speaker*" of 6th January 1893) attributes the Russian famine of 1892 in the following terms:—

> "We speak of the deficit (in the Russian Budget) of 1893 as certain, and it is easy to show that it will be so. *The principal cause of the present dearth is the drought during the last spring and early summer, and this absence of rain is greatly due to the devastation of the forests.* The area formerly covered with timber was enormous, the woods belonging to the Crown, to the great landed proprietors, and to the village communities. But the means of transport were then so imperfect and costly that only in the neighbourhood of large rivers did the felling of timber pay. This changed with the construction of railways and the abolition of serfdom; the former gave the possibility of selling with profit, and the peasants abandoned their woods to speculators for what they thought a good price, little thinking of the future; the larger proprietors followed their example; the purchase money was spent in drink and luxurious living, and no one thought of replanting. *Too late has the Government issued a law for the protection of forests. Such a devastation going on for 20 years not only exhausts a source of wealth, but has also other bad consequences.* When the country is deprived of its trees, the earth is dried up and crumbles from the hills; the water coming down from heaven cannot be kept back as is the case with the woods, which act as a sponge, but rushes in torrents into the rivers and disappears in the sea, and the consequence is a gradual diminution of the fertility of the soil and the disappearing of numerous brooklets and small rivers, to help the larger ones show a low water-mark, which proves prejudicial to the navigation."

This view is confirmed by the special correspondent of the "*Times*" (*vide* article "*Through Famine-stricken Russia*" in issue of 18th April 1892), who writes:—

> "I have now travelled over most of the famine-stricken provinces, and I have been struck by the sameness of the picture. Everywhere reckless extravagance meets the eye, the forests have been cut away wantonly, the rivers are neglected, the climate is ruined."

Such also appears to have been the opinion of Major Law, Commercial Attaché to the British Embassy at St. Petersburg, as expressed in his "*Report on Agriculture in the South-Eastern Provinces of European Russia*," commented on in a leading article of the "*Times*" of 17th September 1892, from which the following is excerpted:—

> "It is said that this gigantic natural tillage farm (*i.e.*, the 'black-soil' region) was formerly hedged in by belts of forest, which served the twofold purpose of sheltering it from the desert winds and of increasing the humidity of the climate. It is certain that these forests do not now exist, and that the black-soil country is often scourged by devastating blasts from the steppe, and not infrequently baked by prolonged droughts. The desert winds pile the snow into drifts in winter, which become the source of destructive torrents in the spring. In summer the same winds are so fierce and arid that in the space of a few hours they wither the corn as it stands, while, when they are laden with sands, they smite the soil itself with perpetual barrenness."

Indeed, all writers who have recently published views on this subject seem agreed as to the main causes of the recent Russian famine; and the following extract from an exhaustive article on "*The Penury of Russia*" in the "*Edinburgh Review*" for January 1893 (pp. 17–19) may be said to contain the summary of the best opinions on the matter:—

> "There are two other factors which account for the prevailing distress—first, damages by fire . . . . This is accounted for by the dryness of the climate in summer, the carelessness of the peasants, and the want of organisation for extinguishing fires, which are simply regarded as a calamity sent by God. But the dryness itself is the result of the second factor, the ruthless forest destruction which has been going on for a long time, and has had a serious effect in reducing the average rainfall. The belts of wood attracted and held the moisture, which was slowly distributed for the benefit of agriculture; now in vast regions, as, for instance, on the black soil, there is hardly a tree to be seen, and the consequence is that the underground rivulets which nourished the soil have disappeared. The forests also broke the force of the fierce east desert winds. Now these winds, piercingly cold in winter and scorchingly hot in summer, burst with full fury on the great plains. In summer their blasts are capable of withering the corn in a few days, and with them come sand-storms, which turn fertile land into permanent deserts. The unfortunate experiences of Central Asia, which once was a garden of fertility and now is a desert peopled by nomads only, are repeating themselves. In the province of Astrachan an area of 800 square miles is covered by drift sand; in that of Stawropol whole villages have disappeared, and in 1885 soldiers had to be summoned to clear the sand from the houses. In the province of Tauris the sand now covers 150,000 dessjaetines (= 1·00925 hect.); the same disastrous effects took place in the north, where, after the destruction of the forests in the provinces of Samara, Woronesh, and Tchernigow, hundreds of sandhills arose, which gradually covered the fertile land. A further consequence is that the rivers become shallower. In winter there is nothing to hold the snow, which is blown together into large heaps; these with the thaw dissolve into temporary torrents, washing away acres of tillage and carrying off all moisture before it has had time to soak into the soil. The river beds cannot contain all this water, and inundations occur; but when it has swept down there is no further supply. The Woronesh, on which Peter the Great built his first ships, is now a mere rivulet; the Worskla, which fifteen years ago was a beautiful river, surrounded by woods and pastures, has absolutely disappeared; the Oka has become so shallow that barges coming from Nishegorod were stranded upon its sands. At Dorogobush the Dnjepr can be crossed by carriages; on the Dnjepr the navigation had to be stopped, as its depth was reduced to 2 or 3 feet; and even on the Volga steam navigation is interrupted in many parts, the river not being able to carry away the sandbanks; it is calculated that the volume of its water has decreased by 24,000,000 cubic metres. It is evident that even the most costly works for opening the channels will be of little avail; the cause lies in the devastations of the forests; the law by which the Government interdicted the ruthless fall of timber has come too late, and replanting is slow work, although it is the only remedy against the evil."

And that the ill effects of too rapid and too extensive clearance of the wooded areas are directly noticeable with regard to the pastural capabilities of any tract and the health of the animals grazed over it, as well as prejudicial to the crop-producing capacity of the land itself, might easily be proved. Thus Mr. Frost, V.S., the adviser of the Local Government of Burma in such matters, expressly stated in his Annual Report for 1884 that in his opinion the prevalence of certain cattle diseases in the Prome and Thayetmyo districts was doubtless attributable to the too rapid and extensive clearance of forest, which deprived the cattle of shade and shelter, as well as of proper grazing, during the hot season before the south-west monsoon breaks.

According to the *Forest Administration Report* for 1890–91, the State forests reserved by the Government of India amount to 112,608 square miles out of a total of 894,059 square miles comprised within British India; that is to say, the areas demarcated with a view to their being permanently retained under woodland for future national-economic as well as, in some cases, for financial reasons, at present aggregate about 13 per cent. of the total area. This of course leaves out of consideration many vast stretches of unreserved tree-forest and bamboo-jungle still clothing the hill-sides in rocky tracts with poor soil, as well as large stretches on the richer plains in thinly populated provinces like Burma and Assam, that will ultimately fall under the plough for permanent cultivation. But the mere statement of such percentage gives no indication as to how far the existing forests suffice for the maintenance of a prudent national-economic balance between the maximum of agricultural production and the safeguarding of the supplies of soil-moisture requisite for any agricultural success whatever. Even in a densely-wooded province like Burma, the percentage of woodlands gives no reliable indication of the above nature, for though certain districts have more than the absolutely necessary amount of woodland, neighbouring districts are liable to suffer from insufficient harvests, and even from famine, when the monsoon rains prove deficient in quantity, whilst the danger of damage from floods after heavy rainfall becomes enhanced.

The following telegram is taken from the "*Times*" whilst this essay is passing through the press:—

"Calcutta, 23 August 1891.

"The floods at Tipperah have proved more serious and extensive than any previously known in the district, and have occasioned the greatest distress among the inhabitants. It is feared that an epidemic may break out as soon as the waters subside."

And a week later, in the "*Daily News*" of 2nd September 1893, it is recorded that:—

"Calcutta, Friday Night.

"Floods of an unprecedentedly serious nature have occurred in Behar. Many hundreds of square miles are under water. Half of the towns of Mozaffurpur and Darbhanga have been submerged, including a great number of villages. The railway line was breached in four places. The paddy crops have been completely destroyed, and the prospects of rice are very gloomy. Much sickness prevails amongst the men and cattle. Thousands are without houses to live in. Floods have also occurred in the Tippera and Dacca districts and in other parts of Eastern Bengal, where there is imminent danger of a famine."

As floods of such enormous magnitude as to cover "*many hundreds of square miles*" must be due to abnormal aqueous precipitations,—acting most probably in conjunction with late melting of the abnormally heavy snowfall of last winter in the Himalayan tracts, where the various main sources of the Gangetic tributaries take their rise,—it necessarily follows that a repetition of similar heavy floods in any future year when the two factors of rainfall and snow-melting may again combine to produce like results, can only be prevented by retaining, more or less as "*ban-forests*," larger and denser masses of woodlands in the catchment areas near the sources ot watercourses for the purpose of retarding the off-flow and regulating the movement of the water ultimately carried off to the great rivers of the plains.

In the Indus valley similar floods are also now (September 1893) announced as interfering with the commerce of Kurachee. These must likewise be due to a similar inadequacy of forest in the great catchment area of the sources of the five great rivers and their tributaries which drain the north-western portion of our Indian empire.

Whether or not steps towards the prevention of a recurrence of the disasters of the present summer lie within the range of practical Indian politics, is a question with which this essay is not concerned.

According to the *Forest Administration Report* for 1891–92 the forest area in Bengal is as follows:—

Reserved forests	5,211	square	miles	Forming only 8 per cent. of the total area of the province.
Protected ,,	2,181	,,	,,	
Unclassed ,,	4,534	,,	,,	
	11,926	,,	,,	

Now probably the greater part of these forests is situated on the Himalayan slopes, so that the total woodland area distributed over the agricultural tracts of Bengal is considerably less than 8 per cent. That is to say, during any year in which the moisture-laden monsoon may perhaps be forced to part with an abnormal proportion of its moisture on the plains, the forests situated near the sources of the river-feeding streams, and forming the larger or smaller local water-catchment areas of the various low-lying districts, must prove themselves insufficient to retain the rainfall temporarily so as to regulate its flow, and thus avoid the formation of the destructive local floods of a more or less serious nature.

In order to obtain the full national-economic benefits that are derivable from woodlands, the areas reserved as forests should be scattered over the face of the country as equally as possible Where the population is thin, and primeval forest is still to be found, measures with this end in view can easily be carried out without inflicting any apparent hardship on the existing community. Where danger from famine is apt to recur from time to time, it would at the same time seem to be worthy of consideration whether it would not be recommendable to expropriate tracts of the poorer and higher land here and there, and plant them up on a well-considered scheme, for the purpose of ameliorating the climatic conditions for man and beast in the future.

ON THE
ADVANTAGES OF UNDERPLANTING
THE
LIGHT-DEMANDING, THINLY-FOLIAGED SPECIES
OF
FOREST TREES.

BY

JOHN NISBET, D.OEC.,

OF THE INDIAN FOREST SERVICE; AUTHOR OF "BRITISH FOREST TREES AND
THEIR SYLVICULTURAL CHARACTERISTICS AND TREATMENT," TRANSLATOR
OF KAUSCHINGER-FÜRST'S "PROTECTION OF WOODLANDS," ETC.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

1893.

TABLE OF CONTENTS.

THE ADVANTAGES OF UNDERPLANTING THE LIGHT-DEMANDING, THINLY-FOLIAGED SPECIES OF FOREST TREES.

Page

Introduction - - - - - - - - - - 3

Objections raised by Opponents of Underplanting - - - - 5

Arguments adduced by Advocates of Underplanting - - - 9

Investigations made by the Forestry Branch of the Faculty of National Economy in Munich University, in order to ascertain the actual Effects of Underplanting :—

- First Series of Investigations - - - - - 11
- Second Series of Investigations - - - - - 15
- Third Series of Investigations - - - - - 18

Practical Conclusions deducible from the Munich Investigations - - 20

Recapitulation - - - - - - - - 29

ON THE

ADVANTAGES OF UNDERPLANTING

THE

LIGHT-DEMANDING, THINLY-FOLIAGED SPECIES

OF

FOREST TREES.

ONE of the most important principles of sylviculture is the conservation of the productive capacity of the soil, and it is only when measures are carried out in that direction that a permanent sustained yield of the best classes of timber is possible. The first step towards the practical attainment of this object is undoubtedly the protection of the soil against insolation by means of a leafy canopy giving shade, and also against the drying action of winds by means of a covering of dead leaves and *humus* or vegetable mould. Certain thickly-foliaged forest trees, like the beech, spruce, Douglas, Nordmann's, and silver firs, are naturally endowed with the requisite soil-protective qualities throughout their whole period of development until maturity. But many of our most valuable species, like oak, ash, maple, birch, larch, and pine, lose their power of protecting the soil at a comparatively early age, long before they attain their normal maturity as forest crops; and in consequence of the interruption that takes place in their canopy, the effects of insolation and of the action of wind and rain on the soil tend to weaken its productive power, and, if unchecked, ultimately lead to its deterioration sooner or later.

To counteract the natural consequences of early interruption of canopy due to increased individual demands for light and growing-space, the best means at hand consist in the under-planting of forests of light-demanding trees with other species

Y 24778.—6. 650.—10/98. I. 1588.

content with less supplies of light, air, and warmth. Through the foliage of these the soil is kept cool and moist, whilst a good layer of vegetable mould is further provided for the enrichment of the soil by the annual defoliation of the leaves or needles; the direct influence of this measure makes itself apparent in the more annual rapid increment on the standards.

In the naturally open forests of oak, for example, there is usually some spontaneous undergrowth; but when this consists of brushwood or scrub its beneficial influence is by no means so marked as in the case of artificially-formed underwood consisting of beech or hornbeam. The first recorded occasion on which underplanting of oaks was carried out for the express purpose of "*giving a covering of fallen leaves to a soil already*" "*overgrown with whortleberry, and thus strengthening its*" "*productive capacity and stimulating the diminished incre-*" "*ment of the oaks,*" took place in the Spessart Forest in Central Germany about 1840,[*] but since then the practical advantages of such a measure have not failed of recognition, as it leads to considerable financial improvement in the further development of the standards.

There are, however, two distinct methods in which the measure can practically be carried out. The undergrowth may have solely the object of temporarily retaining or improving the productive capacity of the soil; or it may be formed with the intention of allowing it to grow up and ultimately form a portion of the crop which is to be harvested in its full maturity at the end of the period of rotation. In the latter case it also affords the sylviculturist the opportunity of forming mixed instead of pure forests for the succeeding crop, and thereby obtaining a class of forest which certainly needs more attention in the way of tending, but has many solid advantages over pure forests in yielding larger crops of greater technical value, and in comparative immunity from the attacks of insect enemies and of fungoid diseases.[†]

But although the practical advantages of underplanting should have been apparent to all, there were not wanting those who condemned the measure on the ground that the undergrowth consumed the nutriment available in the soil in place of stimulating the standards to enhanced increment, whilst at the same time it often entailed considerable outlay.[‡] These objections have, however, fortunately brought the matter under the notice of the experimental section of the Forest Branch of the Faculty of Economic Science in Munich University, and in the following pages a short resumé will be given of the results of the investigations made, and the practical deductions drawn from the observations recorded.

---

[*] See "*Monatschrift für Jagd-und Forstwesen,*" 1874, page 1.

[†] See essay "*On Mixed Forests, and their Advantages over Pure Forests,*" pages 5–18.

[‡] See Borggreve in "*Forstliche Blätter,*" 1877, page 220, and 1883, page 41.

OBJECTIONS RAISED BY OPPONENTS OF UNDERPLANTING.

The experiments on which the opponents of underplanting based their objections were of three classes :—

I. Experiments made with standards over coppice.

II. Observations recording the rate of growth in forests that had been underplanted for some time, and comparison with the rate of growth in other portions of the same timber crops that had not been underplanted.

III. Clearance of underwood in forests that had been underplanted, and comparison of the increment of the standards in the following year with that of those growing over underwood.

Borggreve maintained as regards I. that the increase attained in the breadth of the annual rings was only apparent up till the fifth year, whilst after that a decrease in the breadth was noticeable as soon as the underwood began to form canopy, and that the decrease became more marked with the increasing density of the canopy. He contended that the initially-enhanced increment was due to the diminution in the number of individual plants enjoying insolation and utilising the nutriment of the soil, and had nothing to do with the quicker decomposition of the dead foliage; he even maintained that the formation of *humus* or vegetable mould was interfered with by the full exposure to sun and wind, and to the extremes of moisture and temperature, which hindered the normal development of fungoid growth. As, however, the degree of insolation of the standards could not be affected by the removal of the coppice growth, the enhanced increment during the following five years must have been due to the more rapid formation of humus, and consequently to larger supplies of nutrient salts in the soil in a soluble condition, resulting from the decomposition of the layer of fallen leaves; for during the first few years, when the stool-shoots show their most energetic growth, they make *at least* as high demands on the nutrients in the soil as they do later on when forming close canopy. As coppice shoots flush at once in the first year, his assertions about the production of humus being interfered with have no value; for the young shoots protect the leaves from being blown about, and act in the direction of modifying the extremes of moisture and temperature, thus favouring the normal process of decomposition. That the enhanced increment of the standards decreases about the fifth year merely shows that the extra supplies of nutrient salts, afforded by the richer decomposition of humus after the periodical cutting back of the coppice, become exhausted after between four to five years. An additional objection to these experiments is that the observations were only made at the lower end of the stem in place of all along the bole; for experiments made by Weise on oak standards show that after each clearance of coppice there is an enhanced increment on the lower portion of the stem mostly, but that towards the end of the period of rotation of the coppice, after the twentieth year of undergrowth, the increment near the base of the stem decreases, whilst it becomes enhanced further up the bole, thus leading to a nearer approach to the cylindrical form and to higher general technical and financial value of the timber.

Under II. and III. the following results of experiments were quoted:—

Experiment.	Class of Forest.	No. of Stems per Acre.	Diameter of Average Stem.	Height of Average Stem.	Cubic Feet per Acre.
			Ins.	Ft.	
No. 1	64-year-old Scots pine forest without underwood.	224	10·4	61·6	3,497
	64-year-old Scots pine forest with spruce underwood.	216	9·6	59·6	2,895
No. 2	42-year-old Scots pine forest without underwood.	494	6·1	44·0	2,050
	42-year-old Scots pine forest with spruce underwood.	453	5·1	36·6	1,090

These data were found to be far from conclusive, as the reliability of the former was materially shaken when the latter case was found to be a mixed forest of equal-aged pine and spruce (probably raised from sowing), where the struggle between the two species had been so keen as to affect the development of the pine, which only began to show good annual increment after the spruce had been so interfered with in development as to necessitate their being thinned out, whilst in the portion shown as "with spruce underwood" the struggle was still going on, and the predominating pines suffered in consequence a partial loss of the annual increment they might otherwise have shown under normal conditions.

Measurements made by Zetsche in a 48-year-old Scots pine forest growing on sand, and underplanted with spruce 8 feet high, gave the following results:—

48-year-old Pine Forest.	Diameter of Average Stem.	Height of Average Stem.	Cubic Feet per Acre.	Total Basal Area of Stems.	Increment of Basal Area of Stems in the three years.			
With spruce underwood	Ins. 6·2	Ft. 50·0	2,709	Sq. ft. 986·4	1875-77 .	Sq. ft. =86·76	1878-80 . .	Sq. ft. = 82·08
Without underwood .	6·2	50·3	2,809	1,015·2	Previous to clearance of underwood in 1877. .	=98·96	After clearance of underwood in 1877.	=117·36

A subsequent revision of the experimental areas three years later (in 1883) confirmed the original data;* but as the areas only amounted to 0·225, 0·3, and 0·625 acres respectively, importance can hardly be attached to them as representing the natural state of affairs on a larger scale. As the mean average height of a plantation gives† a very sound means of judging of the quality of the soil, it appears evident that on the areas not underplanted the soil was somewhat better than on the other localities.

Observations made by Michaelis‡ in an oak forest with an 18-year-old undergrowth, chiefly of hornbeam and hazel in close canopy, showed that there was no practical difference between the annual increment on the standards there, and what was found on those in a different part of the same crop, which had been fenced off as a game-cover, and where the deer had browsed to such an extent on the shoots that there was practically no underwood. He noted, however, that the dead foliage was retained better, and was less liable to be blown away, on the part with undergrowth. That, in general, the productive power of soils can be retained without underplanting can hardly be safely argued from this one example, for in this particular case the relations of the soil as to moisture, exposure, &c., were not stated in detail.

---

* See "*Forstliche Blätter,*" 1884, page 173.

† See Grebe's "*Betriebs-und Ertragsregelung,*" 2nd edition, 1879, page 114.

‡ See "*Forstliche Blätter,*" 1884, page 345.

Other observations were also made by him in 100 to 110-year-old pine forests, with beech undergrowth, and having a N.E. exposure; the following were the results he obtained.—

Scots Pine, 100 to 110 Years old.	Last 5 Years.	Last 6 to 10 Years.	Last 11 to 15 Years.
	Inches.	Inches.	Inches.
With undergrowth - -	0·296	0·292	0·400
Without undergrowth - -	0·316	0·356	0·400

The measurements were made by means of Pressler's "increment gauge," but it is not stated that all the spills of wood used for the countings were taken from that part of the stem which represented the true average annual increment of the stems. Few stems are cylindrical; hence, unless all the stems be operated on with the borer in similar proportion to the true increment, the data are not reliable. To have ascertained the true average breadth of the rings four spills should have been extracted from each stem at an equal height N., E., S., and W., and the mean of their measurements taken; yet this was not done. There would, however, have still been a serious flaw in the data, namely, that the measurements should not have taken place at breast-height only, but also in the upper portion of the stem. Michaelis made further observations in respect to a small 110-year-old oak plantation in the open, which was part of a grazing-ground till it was underplanted with silver fir in 1859, without being previously thinned or partially cleared. The measurements were made on sections taken at 3½ feet above the ground and at the top of the bole, just below the crown, the mean being used for purposes of comparison. The breadth of the annual rings was, in comparison with what it had been in the six years previous to underplanting,—

For the 1st six years after underplanting, 1·14 times as much.
„ 2nd „ „ „ 1·52 „
„ 3rd „ „ „ 1·13 „
„ 4th „ „ „ 1·10 „

These results he sought to explain away by the fact that at the time of underplanting the young plantations were closed to grazing or mowing, whilst the dead foliage of the oaks (and later on of the silver fir in addition) was retained for the formation of humus in place of being blown away by strong winds. He further ascribed the gradual diminution in increment throughout the third and fourth periods of six years after underplanting to the large claims that the undergrowth began to make on the nutrients available in the soil, and maintained that, although it still remained greater than before underplanting was carried out, this simply showed that the effects of grazing and exposure to the action of winds were more injurious than the removal of a portion of the soil-nutriment by the silver fir underwood. That oaks will thrive better in the open when the herbage is not removed from the soil seems extremely probable; but there is nothing in the above record to show that the diminution in the increment is not due to the oaks beginning to form a somewhat closer canopy, and to demand thinning or partial clearing with a view to stimulating afresh their productive power.

This closes the brief for the opponents of underplanting, and the case may now be stated for those in favour of the method as a means of enhancing the productive capacity of the soil, and stimulating the standard trees to livelier growth and to the formation of broader annual rings of wood.

ARGUMENTS ADDUCED BY ADVOCATES OF UNDERPLANTING.

In 1886 Frömbling* published the results of measurements made on 160-year-old oaks growing on what was formerly grazing land, but which had been underplanted 35 years previously. In the case of three stems, which had been left close together without thinning, the breadth of the annual zones was at its minimum at the time of underplanting, but increased as the undergrowth formed canopy, and attained a breadth unequalled by any annual zones even during the previous 50 to 60 years, when the natural energy of growth of the trees was greatest. The other stems, which had been thinned or partially cleared, showed at first considerable increment in the breadth of the annual zones in consequence of the thinning out; this, however, fell off for three years, and then increased again when the underwood improved the soil by forming canopy and yielding humus by the decomposition of the dead leaves. The results of Frömbling's experiment were therefore diametrically at variance with those recorded by Michaelis, and were at the same time not open to any doubt as to possible differences in the quality and physical properties of the soil and situation.

More extensive observations were classified in the same journal by Runnebaum,† who recorded the measurements made on two areas under Scots pine, one of which was 120 years old and underplanted with beech, the other a 110-year-old crop without underwood, situated half a mile distant from the former. An examination of the soil showed only inconsiderable differences as to its mineral composition, but the thick humus layer in the underplanted area had nearly double the quantity of mineral nutrients that were traceable in the thinner layer of mould in the forest without undergrowth. The outturn from the two equal sample areas was as follows, the price being 3·8*d.* per cubic foot in the former case and only 2·7*d.* in the latter :—

---

* "*Zeitschrift für Forst-und Jagdwesen,*" 1886, page 633.

† " " " 1885, pages 156 *et seq.*

A.—120-year-old Scots pine underplanted with beech = 14,280 cubic feet pine + 343 cubic feet beech = 229*l.* 2*s.* + 27*l.* 13*s.* = 256*l.* 15*s.*

B.—110-year-old Scots pine without underwood = 13,370 cubic feet pine = 149*l.* 2*s.*

The first thing to strike one here is that, although (in consequence of heavier thinning of A at the time of underplanting) the annual average increment on A was only 119 cubic feet, whilst on B it amounted to 121½ cubic feet, yet there was a considerably higher price (+ 1·1*d.* cubic foot) derived from the pine growing over underwood, in consequence of its being straighter and smoother, more cylindrical in bole, and having annual rings *with proportionally larger development of the summer zone*, which, as is well known, is much more durable in conifers than the more porous spring zone. Here we have a confirmation of Prof. R. Hartig's theory that the underwood, by keeping the soil moist and cold in early spring, prevents the premature awakening of vegetation ; in consequence of this the cambial activity is delayed for about a fortnight at least towards the warmer season of the year, when, in consequence of the greater warmth, the energy of the assimilative process and the formation of woody-fibrous tissue with thick cell-walls are materially enhanced. The greater freedom from branches must, to be fair and impartial, not be ascribed to any influence exerted by the undergrowth. It was probably due to an admixture of beech with the pine at the time of forming the forest; it had no connection with the beech underwood that sprung up spontaneously about the 60th or 70th year, as the natural clearance of all the lower branches must have been completed by that time. Measurements showed that after the spontaneous growth of the underwood the difference in diameter-increment became marked and continuous, as under :—

Diameters.	At 50 years.	At 80 years.	At 100 years.
A - - -	8·4 inches	12·0 inches	13·6 inches.
B - - -	7·4 „	10·0 „	11·2 „
Difference -	1·0 inches	2·0 inches	2·4 inches.

One point in which the Munich experiments, immediately about to be recorded, are acknowledged to be unsatisfactory is that, although over 7,500 acres of high forest have been underplanted, forests without undergrowth, but otherwise absolutely similarly situated as to soil, situation, exposure, method of past treatment, &c., are wanting to form an absolutely accurate comparison. But in comparison with the above-mentioned experiments they have at any rate the advantage of having been made so as to take into account the increment in height; or in other words, that not merely the breadth of the annual rings, but also the superficial increment and the increment in cubic contents have been reckoned and chronicled,—and this is the only method which can yield truly reliable data.

INVESTIGATIONS MADE BY THE FORESTRY BRANCH OF THE FACULTY OF NATIONAL ECONOMY IN MUNICH UNIVERSITY, IN ORDER TO ASCERTAIN THE ACTUAL EFFECTS OF UNDERPLANTING.

First Series of Investigations.

The first series of experiments, or more correctly of investigations, was conducted in an 82-year-old oak forest (*Quercus pedunculata*) on deep, fresh, loamy sand, underplanted 28 years previously with beech, which had partly grown up into the crowns of the standards; the soil was covered with a dense layer of dead leaves and humus. The preliminary outturn from thinnings had not been recorded in any available form. A sample area showed the outturn per acre to be:—

Per Acre.	No. of Stems.	Basal Area.	Diameter of Average Stem.	Height of Average Stem.	Contents of Bole.	Contents of Branches.	Total Cubic Contents.
		Sq. ft.	Inches.	Feet.	Cub. ft.	Cub. ft.	Cub. ft.
Oak -	136	770	11·48	65	7,000	875	7,875
Beech -	2,960	273	1·48	28	—	—	—

The calculation of the cubic contents was made by means of two sample stems taken from each of the three girth classes formed by the standards. The oaks being 82 years old, and underplanted when 54 years old, the details on pages 12 and 13 were obtained by counting back, and by measurement of the annual rings included in the various periods of time.

No. of Sample Stem.	Total Height of Stem.	Height at which Crown began.	Height above Ground of the Sections examined.	Present Diameter (free of Bark) in Inches.	Periodical Diameter-Increment in Inches.					Periodical Superficial Increment in Square Feet.				
					Years before Under-planting.		Years after Underplanting.			Years before Under-planting.		Years after Underplanting.		
					20–10.	10–0.	0–10.	11–20.	21–30.	20–10.	10–0.	0–10.	11–20.	21–30.
1	Feet. 60·6	Feet. 28·6	Feet. 4·3	6·16	1·00	0·60	0·88	0·44	0·40	0·0374	0·0275	0·0473	0·0264	0·0288
			16·6	5·36	0·88	0·76	0·84	0·56	0·48	0·0242	0·0253	0·0363	0·0296	0·0275
			33·3	4·00	—	1·68	0·76	0·52	0·76	—	0·0231	0·0209	0·0176	0·0297
			39·6	3·20	—	—	0·76	0·64	0·72	—	—	0·0182	0·0165	0·0220
			46·2	1·88	—	—	—	0·52	0·80	—	—	—	0·0055	0·0145
							Periodic Increment in Cubic Feet -			0·4410	0·9275	1·2915	1·0115	1·2285
2	56·0	—	4·3	7·00	1·00	0·84	1·12	0·60	0·44	0·0385	0·0407	0·0660	0·0407	0·0330
			16·6	6·00	0·76	0·92	0·96	0·60	0·48	0·0231	0·0352	0·0473	0·0341	0·0319
			33·3	4·80	0·48	1·32	1·12	0·80	0·56	0·0044	0·0253	0·0363	0·0341	0·0275
			39·8	3·76	—	1·40	0·80	0·76	0·64	—	0·0143	0·0176	0·0231	0·0253
			6·2	2·68	—	—	0·80	0·76	0·64	—	—	—	0·0143	0·0165
							Periodic Increment in Cubic Feet -			0·7560	1·2950	1·8620	1·5065	1·3475
3	67·3	33·3	4·3	9·40	1·52	1·04	1·56	0·76	1·00	0·0770	0·0671	0·1023	0·0671	0·0868
			16·6	7·96	1·16	1·16	1·12	0·76	1·00	0·0440	0·0594	0·0704	0·0561	0·0614
			53·3	6·40	1·04	1·24	1·36	1·04	1·16	0·0154	0·0330	0·0550	0·0561	0·0737
			50·6	3·00	—	—	1·20	0·76	0·84	—	—	0·0121	0·0165	0·0242
							Periodic Increment in Cubic Feet -			1·6310	2·0615	3·0100	2·5810	3·6805

No. of Sample Stem.	Total Height of Stem.	Height at which Crown began.	Height above Ground of the Sections examined.	Present Diameter (free of Bark) in Inches.	Periodical Diameter-Increment in Inches.					Periodical Superficial Increment in Square Feet.				
					Years before Under-planting.		Years after Underplanting.			Years before Under-planting.		Years after Underplanting.		
					20-10.	10-0.	0-10.	11-20.	21-30.	20-10.	10-0.	0-10.	11-20.	21-30.
4	Feet. 68·6	Feet. —	Feet. 4·3	9·40	0·76	0·88	0·80	0·52	0·40	0·0539	0·0693	0·0704	0·0495	0·0596
			16·6	8·44	0·72	0·80	0·76	0·56	0·40	0·0440	0·0550	0·0594	0·0473	0·0368
			33·3	6·00	0·92	0·96	0·64	0·48	0·40	0·0308	0·0429	0·0341	0·0286	0·0253
			50·0	3·60	—	1·20	0·88	0·64	0·44	—	0·0143	0·0209	0·0198	0·0165
			56·6	—	—	—	0·90	0·72	0·56	—	—	0·0110	0·0154	0·0121
					Periodic Increment in Cubic Feet -					1·7150	2·3135	2·3555	1·9495	1·5925
5	71·3	30·0	4·3	12·88	1·92	1·32	2·96	1·68	1·52	0·0990	0·0913	0·2728	0·1969	0·1961
			16·6	10·12	2·08	1·56	2·16	1·60	1·16	0·0638	0·0781	0·1518	0·1452	0·1199
			33·3	8·44	—	1·88	2·60	1·80	1·44	—	0·0396	0·1177	0·1243	0·1232
			50·0	4·60	—	—	1·64	1·40	1·44	—	—	0·0220	0·0418	0·0627
					Periodic Increment in Cubic Feet -					1·9285	2·6420	6·9660	6·5695	6·6325
6	75·0	—	4·3	13·48	1·52	1·36	2·36	2·04	1·84	0·0903	0·1012	0·2244	0·2420	0·2871
			16·6	11·44	1·52	1·28	2·16	1·68	1·56	0·0715	0·0792	0·1738	0·1694	0·1815
			33·3	8·08	1·04	1·68	1·68	1·60	1·56	0·0154	0·0495	0·0803	0·1045	0·1265
			50·0	4·56	—	—	0·96	1·12	1·24	—	—	0·0196	0·0363	0·0550
					Periodic Increment in Cubic Feet -					2·1385	3·0450	6·1720	7·0280	8·0535

Immediately before the underplanting took place a partial clearance or strong thinning was carried out, which, as is usual is such cases, of itself stimulated the trees to greater energy in the formation of broad annual rings, but in such a manner as to lower the form-factor, *i.e.*, to induce a tapering form of the bole, the rings being considerably broader near the base than further up near the top. After 10 years, however, when the underwood began to form close canopy, a not inconsiderable diminution of increment and of the breadth of the annual rings resulted near the base, which was succeeded in the following or third decade by a slight increase again in the case of four out of the six sample trees. But along with such diminished increment during the second decade, there was at the same time, in consequence of the underwood forming canopy, an unmistakable effort on the part of the standards to assimilate their mode of increment towards what it usually is when the trees stand in close canopy in place of being in free enjoyment of light and air, namely, a raising of the form-factor or improvement in the shape of the bole, due to the rings near the base of the stem being much narrower than those immediately under the crown and throughout the upper third of the bole, where indeed the breadth of the rings either remained almost constant or increased somewhat, as may be seen from an examination of the tabular record already given. It may be remarked, that if 10 or 20 years previously the crown had been deeper seated than it was at the time of making the experiments, the measurements would be valueless for the purposes of comparison, but from the appearance of the upper portion of the bole such had evidently not been the case.

These changes in the form-factor and improvements in the shape of the bole are more marked when one examines the data recorded as to the periodical superficial increment, for whilst, immediately after the strong thinning or partial clearance took place, at 33·3 feet it amounted to only 30 to 60 per cent. of that at breast-height, during the third decade it rose to 50 to 110 per cent. If the increment at breast-height alone be taken into consideration, one might occasionally come to results diametrically opposed to those yielded by a more accurate computation of the actual increment; *e.g.*, sample stem No. 3 shows diminution of increment at breast-height, whilst the total increment throughout the stem in the last decade is greater than immediately after the partial clearance in the proportion of 3·6505 cubic feet to 1·6310 cubic feet. This improvement in the form-factor, inconsiderable though it often may be, is due to diminished assimilation of nutrients and production of constructive matter in the crown of the trees, in consequence of which smaller quantities of assimilated nourishment are conducted back to the lower portions of the stem and to the root-system; whilst at the same time the mechanical hindrance offered by the underwood to insolation, and the cold shade cast over the soil, militate against the extraction of such large supplies of nutrients being drawn from the soil as would be the case if the latter were warmed by insolation and the root-system were stimulated by a greater degree of warmth. The diminished productive capacity of the crowns of the smaller and average classes of standards is probably mainly due to the free enjoyment of light and air being interfered with as they expand, whilst in the larger girth classes it may be ascribable to the undergrowth beginning to mingle with the lower portion of the leaf-canopy of the standards, and thus interfering with the assimilative power of the lower foliage.

Second Series of Investigations.

That the above-suggested probable main causes are justified may be deduced from the following data obtained from two 105-year-old oak standards that, after having for at least 20 to 30 years stood with their crowns in the full enjoyment of light and air, were underplanted with beech, now about 40 years old, which, growing in close canopy, was already partially forcing its way up into the lower portions of the crowns of the oaks. The forest occupied a high situation and was unprotected towards west and south, where it bordered on arable land; the quality of soil was below the average, and the oak standards were scattered about singly or in small groups throughout the beech undergrowth. Apart from the influence ascribable to the slightly inferior quality of the soil, the boles of the oaks were short, owing to their formerly having had a large amount of growing-space, due probably to wide planting originally; and whereas records showed that the soil had formerly been overgrown with whortleberries, it now had a thick covering of fallen leaves and a good layer of humus. The underwood was formed during 1843 to 1847 by means of sowing beech-nuts; this was carried out immediately after a thinning, and was succeeded in 1853 to 1856 by a clearance of all diseased stems. The measurements made showed that about eight years after the undergrowth was formed the rate of increment sank considerably, after having increased (owing to the thinning out) at the time of its formation; that the effects of these two heavy thinnings or partial clearances continued for about two decades to reduce the form-factor by causing larger annual increment near the butt-end than at the top of the bole; that during the third and fourth decades after the formation of the underwood the basal increment was lower in No. 1 and the same as previously in No. 2, whilst in both cases the increment in the upper portions of the trees was somewhat greater; finally, that during the fourth decade the superficial increment of the various sections, and the total increment in cubic contents, were practically about the double of what they were throughout the decade previous to the underplanting, which emphatically disposes of the argument that the growth of the standards is injuriously affected by the underwood consuming a large share of the nutrients contained in the soil. That the gradual improvement in the form-factor or shape of the bole was due to the beech underwood interfering with the activity of the most deeply-seated foliage is hardly open to reasonable doubt. The detailed measurements were as follows (see page 17), the oaks being 105 years old at the time of the investigations, and having been underplanted at 65 years of age :—

No. of Sample Stem.	Total Height of Stem.	Height at which Crown began.	Height above Ground of the Sections examined.	Present Diameter (free of Bark) in Inches.	Periodical Diameter-Increment in Inches.						Periodical Superficial Increment in Square Feet.					
					Years before Underplanting.		Years after Underplanting.				Years before Underplanting.		Years after Underplanting.			
					20–10	10–0.	0–10.	11–20.	21–30.	31–40.	20–10.	10–0.	0–10.	11–20.	21–30.	31–40.
1	Feet. 59·6	Feet. 31·3	Feet. 4·0	13·44	1·48	1·12	1·68	2·28	1·40	1·20	0·0858	0·0506	0·1403	0·2387	0·1788	0·1672
			17·3	8·80	1·44	0·96	1·28	1·24	1·00	0·76	0·0440	0·0418	0·0715	0·0858	0·0814	0·0696
			37·3	6·32	—	1·04	1·12	1·08	1·28	1·12	—	0·0165	0·0275	0·0358	0·0668	0·0698
					Periodical Increment in Cubic Feet -						—	3·7485	5·1764	5·1870	5·2010	6·1880
2	69·6	25·3	4·0	13·06	1·88	0·96	1·36	1·52	1·36	1·20	0·1166	0·0748	0·1221	0·1596	0·1650	0·1617
			14·0	11·12	2·08	1·16	1·36	1·32	1·12	0·96	0·0935	0·0726	0·1034	0·1188	0·1166	0·1166
			24·0	9·40	1·88	1·36	1·20	1·20	1·24	1·20	0·0441	0·0572	0·0661	0·0825	0·1012	0·1144
			33·0	7·60	—	—	1·52	1·32	1·40	1·36	—	—	0·0441	0·0594	0·0836	0·1088
			44·0	3·12	—	—	—	0·80	0·88	0·84	—	—	—	0·0088	0·0176	0·0242
					Periodical Increment in Cubic Feet -						—	2·1350	3·1710	3·9725	4·5150	4·8365

Third Series of Investigations.

A third experimental area was again selected in the Spessart Forest, in an 88-year-old oak wood raised from seed on old arable land, and the past history of which was accurately traceable. Throughout the earlier periods of development its growth was good, but about the fortieth year the soil became thickly overgrown with whortleberry, the increment diminished considerably, and the crop had anything but a promising appearance. Without any previous thinning, beech-nuts were sown out in 1840 for the purpose of forming an underwood, but in 1844 to 1847 a strong thinning or partial clearance took place along with underplanting. Light thinnings were made in 1852 to 1854, 1859, and 1873, and in 1887 a further thinning out of about 80 stems per acre took place, leaving from 280 to 320, or in round numbers about 300, per acre, which at the time of the experiment formed close canopy. The effect of the first thinning was only so slight an increase of energy in growth as hardly to make itself noticeable in the breadth of the annual rings, or to affect the shape and form-factor; but slight as it was, it remained traceable during the third and fourth decades in the predominant and dominant stems, whilst the weaker individuals that fell into the subdominant class showed gradual diminution of increment in consequence of their crowns becoming suppressed. In this case the detailed measurements were as follows (see page 19), the oak standards being 88 years old at the time of the investigations, and the thinning out and underplanting with beech having taken place when they were 46 years of age:—

No. of Sample Stem.	Total Height of Stem.	Height at which Crown began.	Height above Ground of the Sections examined.	Present Diameter (free of Bark) in Inches.	Periodical Diameter-Increment in Inches.					Periodical Superficial Increment in Square Feet.				
					Years before Under-planting.	Years after Underplanting.				Years before Under-planting.	Years after Underplanting.			
					10–0.	0–10.	11–20.	21–30.	31–40.	10–0.	0–10.	11–20.	21–30.	31–40.
1	Feet. 67·6	Feet. 43·2	Feet. 4·0	7·44	0·72	0·96	0·72	0·64	0·52	0·0330	0·0528	0·0462	0·0451	0·0341
			14·0	6·72	0·84	0·96	0·72	0·56	0·48	0·0308	0·0462	0·0407	0·0552	0·0330
			24·0	6·20	1·16	1·16	0·80	0·64	0·48	0·0308	0·0462	0·0396	0·0363	0·0308
			34·0	5·16	1·16	1·40	0·96	0·76	0·60	0·0099	0·0297	0·0330	0·0341	0·0308
			40·6	4·08	—	—	1·08	0·92	0·68	—	—	0·0209	0·0286	0·0264
					Periodical Increment in Cubic Feet -					0·8295	1·5940	1·5575	1·6060	1·5365
2	71·6	46·6	4·0	9·40	1·04	1·04	1·20	1·32	1·24	0·0253	0·0312	0·0473	0·0748	0·0704
			14·0	8·32	0·96	1·00	1·16	1·20	1·16	0·0396	0·0462	0·0583	0·0693	0·0715
			24·0	7·92	1·44	1·16	1·12	1·24	1·12	0·0352	0·0484	0·0605	0·0835	0·0691
			30·6	7·12	1·56	1·40	1·24	1·16	1·00	0·0462	0·0473	0·0682	0·0858	0·0913
			37·3	6·52	—	1·60	1·32	1·48	1·08	—	0·0572	0·0814	0·1067	0·1177
					Periodical Increment in Cubic Feet -					1·3055	1·8935	2·7160	3·9480	4·5135
3	74·0	53·3	4·0	9·56	1·36	1·16	1·12	0·96	0·88	0·0693	0·0759	0·0869	0·0847	0·0869
			14·0	8·16	1·36	1·12	0·96	0·92	0·80	0·0539	0·0550	0·0627	0·0682	0·0671
			20·6	7·80	1·96	1·48	1·04	0·88	0·88	0·0539	0·0682	0·0616	0·0616	0·0704
			27·3	7·20	—	2·12	1·16	0·88	0·92	—	0·0726	0·0605	0·0561	0·0660
			34·0	6·88	—	—	1·48	1·12	1·00	—	—	0·0638	0·0649	0·0693
			40·6	6·00	—	—	1·96	1·64	1·28	—	—	0·0451	0·0682	0·0748
					Periodical Increment in Cubic Feet -					1·5890	2·2855	2·8175	3·1780	3·8850

As regards increment in height, the analyses of the sample stems in the above experiments showed that this diminished after the strong thinning or partial clearance, but eventually regained its former level, and in some cases exceeded what it had previously been. So far as any deduction may be allowable from the comparatively small number of sample trees, it seems to be the case that after each thinning the diminution of increment in height was due to the tendency of the oak to expand laterally and internally to the prejudice of the vertical energy, which, however, regained its ascendancy when once the crowns again began to form close canopy.

Such are a few of the most important of the data obtained by the experiments of the Forest Branch of Munich University, conducted by Dr. Kast, lecturer on Forestry, who has kindly permitted me to make free use of his investigations on the subject.* As previously stated, although practically conclusive, they are still open to the scientific or academic objection that they fail to yield comparisons with actual measurements made on forest crops of absolutely similar nature growing on soils and situations also absolutely similar in quality and physical and climatic conditions, but differing only in never having been underplanted or never having had any artificial underwood formed below them.

The practical conclusions which it appears justifiable to deduce from these three series of carefully-made measurements may now be stated.

PRACTICAL CONCLUSIONS DEDUCIBLE FROM THE MUNICH INVESTIGATIONS.

When forests of light-demanding species are underplanted, and the underwood begins to form close canopy, the effect is to produce a simultaneous diminution of the breadth of the annual rings in the basal portion of the stem, but to a much less extent, or not at all, in the upper portions of the bole, and without always diminishing the total annual increment on the tree. Wherever any considerable diminution of annual increment takes place in individual stems, it is probably due to re-formation of close canopy after thinning or partial clearance, in consequence of the full development and assimilative activity of the coronal foliage being interfered with.

---

* *"Ueber den Unterbau und seine wirthschaftliche Bedeutung,"* 1889.

Runnebaum's experiments confirmed, so far as the Scots pine is concerned, Professor R. Hartig's theory that better and heavier timber is produced when there is underwood than when the soil is unprotected; but, as already explained, the other experiments could not yield final or academically satisfactory results. So much could, however, in a general way be deduced that, though favourable in other physical respects, undergrowth does not, as was generally accepted, directly stimulate to greater annual increment, owing to its withdrawing a portion of the nutrient salts from the soil. But the quantity of nutrients thus tapped is very inconsiderable, and does not at all justify the outcry of the opponents of underplanting, more especially on the better classes of soil. Their argument that, when thinnings or partial clearances are made, the spontaneous growth of grasses and weeds restores annually to the soil the nutrients taken from it, overlooks the fact proved by Vonhausen* that a soil covering of grass withdraws about four to five times as many nutrient salts as are utilised by beech undergrowth, and that as the humus formed by such soil-covering is almost entirely consumed by the superficial growth of weeds, the total of nutrients requisite for the maintenance of the annual development of the soil-covering is practically withdrawn from the possibility of being utilised by the timber crop,—whilst in comparison with that the quantity annually withdrawn by the underwood is inconsiderable, or at any rate so very much smaller as hardly to be practically taken in account, in the case of soils above the average, so far as concerns the further development of the standards. For the poorer classes of soils, however, it may possibly make its influence felt when the underwood is dense; but this will be more than counterbalanced by the larger increment which will follow thinnings or partial clearances in such cases in comparison with similar measures of tending carried out on tracts unprovided with undergrowth, in consequence of the greater supplies of dead foliage available for decomposition under the stronger action of light, air, and warmth. That the underwood can under certain circumstances make higher demands on the nutritive capacity of the soil than are preferred by the standards is of course self-evident, for it would be useless to attempt to underplant pine woods with beech on the poorer classes of sandy soil.

Next to the influence exerted on the total annual increment comes the question of the quality of the timber produced. This is mainly influenced by a high form-factor, by freedom from branches and knots, by a large proportion of heartwood to sapwood, and finally by the height of the specific gravity, as for any mature samples of one and the same species of timber (in an equal stage of seasoning) it is incontrovertible that the heaviest is the most durable.*

---

* "*Allgemeine Forst-und Jagd-Zeitung,*" 1872, page 1.

The specific weight of any kind of timber *per se* is directly dependent on the proportion which the hard, dense, heavy zone formed during the hot weeks of summer bears to the lighter porous spring zone in the annual ring. The longer that activity of vegetation is delayed in spring, and the more it is forced into the warmer weather of summer, the denser, heavier, and technically preferable will be the timber produced; and as the practical effect of the underwood is to maintain the soil cool in spring by reason of the mechanical hindrance it offers to insolation and consequent direct heating of the ground, it delays, with favourable results for the quality of the timber to be formed, the annual commencement of vegetation for at least a fortnight. For timber crops treated under the method of partial clearance this is of very great importance, as otherwise the approximate isolation of the standards would directly lead to the production of a poorer quality (although larger quantity) of timber than previous to the thinning out or partial clearance.

That the underwood is also of practical utility in clearing the lower branches from the stem hardly needs any demonstration. As it gradually grows up into the lower portions of the crowns it not only suppresses the foliage of the lower branches that can still maintain a struggling existence under the partial shade of the crowns, but otherwise aids mechanically in breaking off dead branches; and by maintaining the soil cool and moist it also assists materially in hastening their decomposition. This function of the undergrowth is, however, not of the first importance; for by the time it grows up into the lower crowns the natural thinning of the lower branches in normally developed forests should practically have already been completed.

From the experiments it seems warrantable to conclude that the older the underwood and the higher up it reaches into the lower portion of the crown, the greater is its influence in improving the form-factor and the consequent utility and technical and financial value of the stem; but these advantages are counterbalanced by a general reduction in the annual productive capacity of the tree if the undergrowth be allowed to grow up high enough to interfere so far with the normal development of the crown of the standard trees as to cause partial suppression.

---

* See Gayer's "*Forstbenutzung*," 7th edition, 1888, page 86.

Concerning the natural laws which govern the quantitative relation of heartwood to sapwood practically nothing is yet known, though Runnebaum and others have found that pine standards with beech underwood show a larger proportion of heartwood than the trees grown in pure forests of pine. As, however, the same holds good for mixed forests of pine, spruce, beech, &c., there can be no justification for assuming that underplanting specially favours an increased production of heartwood or lessens the period of semi-activity which the older sapwood has to live through before attaining its highest maturity as duramen.

But the greatest ultimate importance of the undergrowth is undoubtedly to be looked for in the influence which it exerts on the soil, not only physically and immediately, but also throughout long subsequent periods, in consequence of the humus formed by the fallen leaves modifying all the physical properties of any given ordinary soil, and increasing and returning to it in a convenient, easily assimilated, soluble form the previously consumed supplies of nutrient salts. These physical and immediate influences of the undergrowth are everywhere visible in the maintenance of the soil against insolation, in the preservation of the soil-moisture, in the annual fall of leaves and its retention against being blown away, in fixation of the soil on hillsides, and in the slight but gradual assistance afforded by the humus towards effecting the further decomposition of the mineral layers and a consequent enrichment of the soil.

It is true that enormous quantities of moisture are transpired through beech leaves, even when forming undergrowth and in the enjoyment of but a limited supply of sunshine and light, and also that during rainfall a large percentage of the precipitations is caught up by the leaves and branches without reaching the ground; but the importance attached thereto by the opponents of underplanting seems hardly justifiable in the face of the fact that, without a layer of humus or moss, the surface-soil is little able to hold the moisture received as rainfall, whilst the evaporation caused by insolation and by the free play of winds must also be factors of enormous potentiality. As a matter of practical result, Ramann found* that, in the areas experimented on by Runnebaum, from the middle of May till the end of August there was always more moisture immediately underlying the humus in the pine forest underplanted with beech than in the pure pine woods; but below that down to a depth of 2 ft. the soil was moister in the former for the first half of the time, and drier throughout the second half, whilst the layers at about 28 to 32 inches below the surface were always moister in the pure pine woods. The explanation he gave was that in pure pine forests the spontaneous growth of grass, heather, &c., exhausted the superficial supplies of moisture to a greater extent than the beech underwood, whilst the middle layer at about 20 to 24 inches had to furnish supplies to both beech and pine, and that in the pure forest the deeper layer received larger supplies of moisture from the surface after the grasses had completed their development than could be the case where the beech undergrowth covered the soil. Wollny also obtained similar results in independent experiments conducted in Austria, which may briefly be summarised as follows* :—

---

* "*Zeitschrift für Forst-und Jagdwesen*," 1885, page 172.

1. That the quantity of moisture under a soil-covering of living plants is always less during the period of active vegetation than at a similar depth on naked soil, in consequence of transpiration through the foliage, and that this influence is traceable even down to the lower layers.
2. That the quantity found is less, the denser the plants stand, without being inversely proportional to the density.
3. That a soil-covering of dead growth or leaves, up to two inches in thickness, permits of better percolation of moisture from the surface-soil towards the lower layers than the naked soil seems to do.

These investigations, taken in conjunction with Ebermayer's conclusion† that forest soil was moister than similar soil in the open only in the upper layers, but was always drier in those pervaded by the roots, point to the correctness of Ramann's deductions.

The effects of underplanting with beech, hornbeam, or silver fir, which have all got a somewhat similar heart-shaped and moderately-reaching root-system, will be practically about the same; but in the case of the shallow-rooting spruce some modifications of the effects should be noticeable.

---

* Wollny's "*Forschungen auf dem Gebiete der Agricultur-Physik*," Vol. X., page 261.

† "*Die Physicalischen Einwirkungen des Waldes auf Luft und Boden*," 1873, pp. 213–232.

In woods underplanted with spruce the upper layer of soil will still not contain more moisture than in pure forests, as the shallow root-system will draw its chief supplies of water from the soil lying within about 1 to 1½ feet from the surface, whilst below that the quantity of moisture should be about the same, at any rate during the first half of the annual period of vegetation. Owing, however, to the great density of spruce undergrowth, a considerable proportion of the atmospheric precipitations will be intercepted without ever having any chance of percolating through to the lower soil, so that the deeper layers may in general have less moisture than is to be found in similar soils bearing pure forests without underwood. As the foliage of spruce and silver fir is retained throughout the whole year, this not only intercepts a larger proportion of the precipitations during the non-active period, but also requires water for transpiration through the needles; hence, throughout the period during which broad-leaved deciduous undergrowth remains defoliated, the soil under the latter should, *cet. par.*, show larger supplies of moisture than soils bearing coniferous underwood.

It stands to reason that a dense undergrowth throughout a whole forest will withdraw larger supplies of moisture from the soil than one forming merely a loose canopy; and in consequence of this, it may perhaps be found to be of the greatest practical advantage to underplant in groups and patches wherever there is no good soil-covering of dead foliage or moss, as such partial underplanting will probably exert a sufficient influence in protecting the rest of the soil from the bad results of insolation, and in particular from the drying-up effects of winds. And although the former idea, that soils with a covering of underwood were always moister than those without, has not on investigation shown itself to be unconditionally correct, yet the importance of the retention of the fallen leaves, and the prevention of their being blown away by the wind, has in no way been overrated. But to serve this latter purpose something more is necessary than a thickly-foliaged outer fringe or belt along the edges of the forest, unless the compartments are very small and the soil is practically level, though even then the object in view is more safely attained by means of underwood.

It is a practical fact, hardly necessary of any elaborate demonstration or proof, that the more valuable assortments of oak and pine cannot be profitably* produced merely by strong thinnings out and prolongation of the period of rotation, as for their full normal development they demand a larger growing-space for the expansion of their crowns than can be given in pure forests without entailing serious interruption of the canopy, and consequent exposure of the soil to the deteriorating effects of insolation and exhausting winds. Strong thinnings or partial clearance about the 60th to 80th year for oak, or the 30th to 40th year for pine, when (according to the soil and situation) their main growth in height has culminated, and simultaneous underplanting or sowing of the species of shade-bearing trees best adapted for the particular soil, are the only advisable, rational, and remunerative method of stimulating the standards to further active production of good annual increment. It is not denied that the increment will be stimulated by the mere enlargement of the growing-space of the individual trees; but it is maintained, and in the foregoing seems to have been satisfactorily proved, that such enhanced increment on the individual trees must be dearly purchased at the cost of the subsequent deterioration of the productive capacity of the soil and diminution of the annual increment per acre, not to mention the higher technical and monetary value of the timber when the boles are not much inclined to taper.

---

* See essay "*On the Selection of Species of Trees for Woodland Crops, and on the Choice of the Method of Treatment, &c.*," page 27.

Up to the present the underwood has been considered solely with reference to its influence on the later growth and development of the light-demanding standards; but it is also worthy of some special consideration on its own account. Even though all the standards be healthy and of normal appearance at the time of thinning and underplanting, further clearance to a greater or less extent is usually necessary before the utilisation of the whole crop is contemplated; and when there is no underwood, this simply means that on such places the soil is either not utilised at all, or not utilised to its full advantage. Where, however, underwood exists, it can grow up in the blanks to form part of the crop to be finally harvested. In such cases beech and hornbeam will yield less remunerative results than spruce or silver fir; for although, in general, under the shade of the standards, the latter will hardly develop into the better-paid assortments of timber, yet, thanks to the limited growing-space that suffices for the normal development of their crowns, they can of themselves—apart from their beneficial and remunerative influence on the main crop—often yield a good return for the initial costs of underplanting, and a moderate rental for the sub-tenancy of the soil they occupy.

With the maturity of the standard crop the underwood has done its duty, and can either be cleared away for the purpose of reproducing the standards naturally from the seed shed, or be retained for some time longer and treated as high forest, at any rate in groups or patches that show good development and give promise of a fair outturn in timber. Generally throughout Britain, however, where financial principles must mainly guide the landed proprietors in forest matters, and where there is a comparatively small and not very remunerative market for firewood, the clearance of the underwood will precede the reproduction and utilisation of the standard crop. For the under-planting of the deciduous, light-demanding species of our forest trees—oak, ash, maple, and sycamore—beech, and on moister localities hornbeam yield better results on the whole than spruce or silver fir, as they accommodate themselves more to the natural development and habit of growth of the standards. For larch and pine woods, on the other hand, spruce, or on the better classes of soil, and in mild, sunny localities, Douglas, Nordmann's, or silver fir, naturally conform better to the habit of growth of these standard species, though underplanting with beech or hornbeam is still more decidedly advisable wherever the conditions of soil and situation render it possible, owing to the very advantageous influence the broad-leaved species exert in minimising the effects of damage done by insect enemies. In this latter respect their influence is somewhat similar to that of mixed forests, but less strongly marked; it becomes the greater, the more the underwood is able to extend upwards towards the lower portions of the crowns of the standards, and thus form, as it were, an integral portion of the leaf canopy.

But the choice of the species to be used for underplanting is dependent for the most part on considerations as to soil and situation. Without referring to special cases like the growth of alder as coppice under essentially light-demanding species on moist, fertile, rather marshy soils, it is practically limited to the four shade-bearing species, beech, hornbeam, spruce, and silver fir. Of these spruce is certainly most moderate in its demands, and it has another recommendation in deriving its supplies of nutrients chiefly from the upper layer of soil not tapped by the deeper-rooted species, oak and pine; the other three species not only make greater demands on the mineral strength of the soil, but also through their deeper root-systems tend to come more in competition with the standards with regard to the withdrawal of the nutrients held in solution in the middle layers of the soil. Speaking generally, however, broad-leaved species certainly deserve the preference if underplanting takes place simply with a view to the protection and improvement of the soil; whilst a mixture of conifers and broad-leaved species recommends itself wherever it is desired to obtain a crop of fairly marketable stems along with the mature standards. That the greatest improvement in the soil takes place when beech is the underwood is incontestible; but in consequence of its comparatively high demands on potash and phosphoric acid it cannot be used on the poorer classes of soil, and when growing under oak in damp localities exposed to late frosts it suffers considerably more than hornbeam in consequence of its flush of spring leaves coming about a fortnight earlier than those of the standards. Where a choice remains open only between spruce and silver fir, or for admixture of these with the beech or hornbeam, the silver fir in general deserves the preference, notwithstanding its deeper root-system and greater claims on mineral strength of soil, for it bears shade better on the whole, is more favourable to the formation of humus, and does not close the soil so much to the circulation of air, to the reception of atmospheric precipitations, and to the percolation of the surface-moisture down through the upper layers towards the subsoil. For the underplanting of oaks, spruce is not to be recommended, as it is apt to interfere greatly with the functions of the crown later on; for oak-soils the beech, and on moist parts the hornbeam, should form the bulk of the underwood, with silver fir mixed in patches where there seems any chance of its ultimately being likely to develop into good marketable dimensions. The underplanting of oak with spruce has been practically condemned by most of the eminent sylviculturists in Germany. There are several reasons for this, one of them being that, by intercepting and utilising for its own benefit a large proportion of the atmospheric precipitations, it induces "*stag-headedness,*" owing to insufficient supplies of moisture reaching the lower layers of soil; but this disease is often also due to injudicious thinning or partial clearance on soils below the average in quality, and naturally somewhat deficient in moisture, when the evil is, of course, aggravated by the choice of spruce as underwood. Although Weymouth and black or Austrian pines bear more shade than Scots pine, their capacity in this respect is hardly great enough to admit of their being utilised as underwood; much better results are promised by the Douglas and Nordmann's firs, which closely resemble the silver fir in many respects.

The opinion was formerly general among sylviculturists that the full advantages of underplanting were only obtainable when the whole area was under cover; but although the fullest returns from dead foliage can undoubtedly be thus secured, other points of view seem to indicate that partial underplanting can also attain desirable results, whilst at the same time obviating certain drawbacks relative to the too extensive demands of a full, dense undergrowth on the moisture of the soil. For such partial underplanting in patches or small groups the advantages claimed are that by occupying only a portion of the soil it competes to a much less degree with the standards in making demands on nutrients, a matter which is of the greater importance, the poorer the soil is; that whilst withdrawing smaller supplies of moisture from the ground it permits a larger proportion of the atmospheric precipitations to reach the soil directly, and at the same time affords the necessary protection, both mechanically and otherwise indirectly, against the rapid evaporation caused by sun and wind; that it stimulates the decomposition of the fallen leaves and needles by favouring the freer play of the necessary factors, warmth, moisture, and atmospheric oxygen, and prevents the accumulation of an unproductive, undecomposed layer of foliage, such as may often be noticed in the case of dense underwood of spruce especially; that it offers the best means of forming mixed undergrowth on all places where soil, situation, or standards require different species from the rest of the area, or any special treatment of the underwood chosen; and that, finally, it costs only a proportional amount of the outlay that the planting up or sowing of the whole area would entail.

RECAPITULATION.

To recapitulate briefly the results of the Munich experiments, it has not yet been shown that the undergrowth exerts any direct and immediate influence on the increment of the light-demanding standards, but it undoubtedly does improve the shape of the bole, and consequently enhances its financial and technical value, and also improves the quality of the timber, at any rate in the case of the light-demanding conifers. Again, by increasing the quantity of fallen leaves and needles, and preventing them from being blown away by winds, it essentially favours the production and direct increase of humus, so that it materially affects the physical properties of the soil and stimulates its productive capacity.

Oak, larch, and pine are the species extensively grown in pure forest which stand most in need of underplanting when once they have completed their main growth in height and begin to make larger demands on growing-space; the other light-demanding species, like ash, elm, maple, and sycamore, should less frequently be grown in pure forest than simply as patches in mixed woods, where a ruling species, preferably the beech, protects the soil against deterioration. Shade-bearing species require no undergrowth. Unless maintained in close canopy they tend to branch development and consequent reduction of the form-factor of the bole, with diminished monetary and technical value; moreover, it is only on the very best qualities of soil that beech, spruce, or silver fir can thrive for any length of time under the dense shade of parent standards forming anything like a full canopy.

Whether the underwood should be formed by sowing or planting depends in each case on local circumstances. Sowing is in the majority of cases much cheaper, but it takes longer to attain the object in view. Planting can be easily carried out, wherever practicable, with seedlings from neighbouring woods or with two to three-year-old seedlings or transplants from temporary nurseries, and should not amount to more than about 15*s*. per acre if put out from 3½ × 3½ to 4 × 4 feet apart by means of notching. But even should the costs of underplanting be higher locally, the advantages of the method are still cheaply obtained where the intention is to produce the most satisfactory monetary returns from pure forests of oak, larch, or pine that are unable of themselves to protect the soil against deterioration, but which it is not desirable to clear away yet for the formation of other crops of timber. Many an oak grove in England, and many a larch and pine tract in Scotland, would yield far more satisfactory returns from every point of view—financially, sylviculturally, technically, and æsthetically—if due measures were taken for the protection and improvement of the productive capacity of the soil by means of underplanting after thinning or slight clearance, and treatment thereafter in accordance with the rational principles of the science of forestry.

SOIL AND SITUATION

IN RELATION TO

FOREST GROWTH.

BY

JOHN NISBET, D.OEC.,

OF THE INDIAN FOREST SERVICE; AUTHOR OF "BRITISH FOREST TREES AND
THEIR SYLVICULTURAL CHARACTERISTICS AND TREATMENT," TRANSLATOR
OF KAUSCHINGER-FURST'S "PROTECTION OF WOODLANDS," ETC.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

1893.

TABLE OF CONTENTS.

Soil and Situation in Relation to Forest Growth.

I.—*Soil in Relation to Forest Growth* - - - - - 3
- 1. The Chemical Composition of Soils - - - - - - 4
- 2 The Formation of Soil - - - - - - 7
  - The Physical Forces - - - - - - 7
  - The Chemical Forces - - - - - - 7
  - The Organic Agencies - - - - - 9
- 3. Classification of Soils as to their Origin and Mineral Composition - 11
- 4. The Physical Properties of Soils - - - - 17
  - (*a.*) Cohesiveness or Tenacity - - - - 18
  - (*b.*) Relation to Moisture - - - - - 18
  - (*c.*) Relation to Warmth - - - - - 21
  - (*d.*) Depth - - - - - - - 21

II.—*Situation in Relation to Forest Growth* - - - - 22
- 1. Climate - - - - - - - - 22
  - (*a.*) Warmth - - - - - - - 23
  - (*b.*) Atmospheric Moisture - - - - - 25
- 2. Aspect - - - - - - - 27
- 3. Gradient - - - - - - - 27
- 4. Elevation above the Sea-level - - - - - 27
- 5. Configuration of the Soil and the surrounding Country - - 29

III.—*Assessment of the Qualities of Sylvicultural Soils* - - - 29

SOIL AND SITUATION IN RELATION TO FOREST GROWTH.

It may be remarked at the outset that much of the following information has been compiled from German sylvicultural works, more especially from Ramann's "*Forstliche Standortslehre*" in Lorey's "*Handbuch der Forstwissenschaft*," 1886, Grebe's "*Gebirgskunde, Bodenkunde, und Klimalehre, in ihrer Anwendung an Forstwirthschaft*," 4th edition, 1886, Gayer's "*Waldbau*," 3rd edition, 1889, and other works specially quoted.

It treats of a subject not strictly falling under any of the four main branches of forestry,—Sylviculture, Protection of Forests, Utilisation of Forest Produce, and Management of Forests,—but concerning which it is at the same time necessary that the forester should have a certain degree of sound knowledge.

I.—Soil in relation to Forest Growth.

Soil is the name given to the product of the decomposition of the rocks forming the crust of the earth. By reason of its permeability and of its other physical properties, it enables trees to obtain support and food-supplies by means of their roots and rootlets. Although woody-fibrous plants derive by far the greatest portion of their nourishment from the carbonic acid (CO_2) contained in the air, yet certain necessary substances are obtainable only from the soil, and the development of forest growth is stimulated when the soil is rich in these mineral substances in forms capable of being taken up by the root-system. The finer and usually most decomposed earth forming the upper layer, and often varying greatly in depth, is called the *soil* or *surface-soil*, from which timber trees draw most of their mineral nutriment; below this is the *subsoil*, which may, or may not, be of the same composition as the soil. The external signs of shallowness of soil are outcrop of stone, inordinate development of the root-system, and inferior development of stem; those of depth of soil are length of bole and good development in height, with richer growth of underwood, brushwood, and weeds to form a soil-covering.

Y 24778.—2. 650.—10/93. I. 1588.

1. *The Chemical Composition of Soils* is in so far of importance to tree-growth that if different kinds of wood be reduced by combustion the ashes will invariably show certain chemical constituents which are absolutely requisite for the formation of the ligneous structure, viz. :—Potash, calcium, magnesia, iron, phosphorus, and sulphur. Each of these necessary foods must be present in sufficient quantity in the soil before plants can find the conditions suitable for their growth and development. The functions performed by these different constituents are believed to be as follows :—

Potassium.—Assimilation, transformation of sap, and formation of starchy matter.

Calcium.—Formation of cell-walls in the cambium.

Magnesia, Phosphorus, and Sulphur.—Formation of albuminoid substances.

Iron.—Formation of chlorophyll in the leaves.

In addition to these the ashes of every plant yield soda and silica, often in very high percentage, whilst manganese and aluminium are also less frequently found.

Most soils yield a sufficient quantity of all these various constituents to enable tree-growth to be possible; they must, however, be held as *soluble salts* so as to be available in a form capable of being absorbed by the suction-rootlets.

In agriculture the productive capacity of land is to a great extent commensurate with the inorganic richness of the soil; but as tree-growth utilises comparatively very much smaller quantities of mineral constituents (especially of those less common) than are demanded by agricultural produce, the capability of any soil is not determinable by the quantity of inorganic matter available for food-supplies, except perhaps in the case of the very poorest classes of forest land.

The actual quantities of mineral substance annually utilised per acre, as found in the ashes of agricultural and forest produce, have beeen shown* to be as follows :—

Average of	Total Quantity of Ashes.	Silica, SiO_2.	Potash, K_2O.	Lime, CaO.	Magnesia, MgO.	Phosphoric Anhydride, P_2O_5.	Sulphuric Anhydride, SO_3.	Other Constituents.
Mixed agricultural produce.	235	37	78	43	17	28	11	21
Woodland growth, timber and leaves.	126	29	11	62	10	8	3	3
Woodland growth, timber only.	19	1·6	4	9	2	1·4	0·4	0·6
Approximate ratio of woodland to agricultural demand for mineral constituents.	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{7}$	$\frac{3}{2}$	$\frac{3}{5}$	$\frac{2}{7}$	$\frac{1}{4}$	$\frac{1}{7}$

---

* Ebermayer's "*Physiologische Chemie der Pflanzen,*" 1882, Vol. I., p. 761.

With regard to the woodland growth, it is notable that the greatest deposits of mineral constituents are found in the leaves, where the preliminary processes take place for carrying out the work of assimilation, then in the bark active in depositing the transformed sap, and that in recently-formed sapwood and branches there is contained about double the quantity that is to be found in the duramen or old wood of the stem, where the total of ashes seldom exceeds 1 per cent.

Weber* gives the average analysis of the dry timber of different species of European forest trees as :—

50	per cent.	carbon.
42	„	oxygen.
6	„	hydrogen.
1	„	nitrogen.
1	„	ashes.
100		

As the total demand on mineral food-supplies made by woodland growth barely exceeds half of that made by agricultural produce, and as through the fall and decomposition of the leaves by far the greater portion of it is returned to the soil, it will be at once apparent that forests of normal density do not exhaust the soil to anything like the same extent as agricultural crops.

According to Prof. R. Hartig of Munich† :—

> "The quantity of mineral food taken up from the soil depends chiefly on the species, for some plants extract greater supplies than others. Thus the spruce, for example, when growing along with the beech in forests, forming close canopy, extracts more raw mineral substance for ashes than the latter. At 50 years of age the relative proportion of production between the spruce and the beech is—

As regards cubic contents of timber - - -	2·78 to 1
As regards dry woody-fibrous tissue - -	1·80 to 1
As regards ashes (mineral substance) - -	1·28 to 1

> These figures prove that spruce not only withdraws more nourishment from the soil than beech, but that it also produces more timber than the beech from any given quantity of mineral nutriment. For the production of any given cubic quantity of beech timber more mineral matter is requisite than for the production of the same volume of spruce."

The absolute demands of the various species of forest trees on the nutrient strength of the soil have not yet been determined, the difficulty being that the mineral constitution is not the only factor, but that all the physical qualities exert their influence under every circumstance, and in the most complicated concrete conditions. Hence their final expression is a resultant that cannot be fixed beforehand. Experience, however, shows that

---

* "*Aufgaben der Forstwirthschaft*" (Lorey's "*Handbuch*"), 1886, p. 72.

† "*Anatomie und Physiologie der Pflanzen*," 1891, p. 227.

European forest trees may be classified as follows in regard to the demands made on the fertility of the soil :—

Decidedly exacting	Elm, maple, sycamore, ash.
Exacting	Oak, beech, lime, silver fir.
Moderate	Sweet chesnut, larch, hornbeam, spruce, alder, aspen, willow.
Least exacting	Birch, Scots, Austrian, and Weymouth pines.

The power of accommodating themselves to soils and situations not naturally suited to their growth and normal requirements is greatest in Scots pine and birch, less pronounced in oak, beech, spruce, and silver fir, and least of all in ash, elm, maple, and sycamore.

It is impossible to say that clayey, loamy, limy, or sandy soils are necessary for any particular species. Extracts from the works of the most eminent German sylviculturists are often absolutely contradictory on this point; whilst G. Heyer,[*] on the other hand, even went so far as to assert that almost any soil could produce any kind of timber, provided it were supplied with the necessary and suitable quantity of moisture. Ney[†] summarises as follows :—

> "As regards chemical composition of the soil, even slightly sour marshy soils are unfavourable to all species of trees except alder, birch, and spruce, whilst sour soils liable to dry up at certain seasons are unsuited for all except birch, spruce, Scots and Weymouth pines. Only these last-named species thrive on pure peat, and not even the spruce when it is dry. Ash, maple, sycamore, and elm require a moderate quantity of lime in the soil, and beech, hornbeam, oak, as also larch and black pine, thrive best on soils that have at least some lime in their composition. The hardwoods—oak, ash, maple, sycamore, elm, sweet chesnut, beech, and hornbeam—also appear to demand the presence of a considerable quantity of potash; whilst, on the other hand, spruce, silver fir, and especially Scots pine and birch, thrive on soils rich neither in lime nor potash."

The primary rocks forming the bulk of the earth's solid body are for the most part made up of only eight elements, the remainder being found in much smaller quantities, as the following table[‡] shows :—

Composition of the Earth's Crust in 100 parts by weight.

Oxygen	44·0 to 48·7	Calcium	6·6 to 0·9
Silica	22·8 to 36·2	Magnesium	2·7 to 0·1
Aluminium	9·9 to 6·1	Sodium	2·4 to 2·5
Iron	9·9 to 2·4	Potassium	1·7 to 3·1

---

[*] "*Forstliche Bodenkunde und Klimatologie,*" 1856, p. 486.

[†] "*Die Lehre vom Waldbau,*" 1885, p. 64.

[‡] Roscoe's "*Elementary Chemistry,*" 1888, p. 8.

Soils are composed for the most part of salts, together with oxides, and less frequently chlorides. These salts consist chiefly of silicates, often in combination with water, of carbonates, and sulphates, whilst phosphates are only of occasional occurrence, although of great importance to plant life. The most important of these constituents are:—Silica or silicon dioxide (SiO_2); carbonic acid or carbon dioxide (CO_2); sulphuric anhydride or sulphur trioxide (SO_3); phosphoric anhydride or phosphorus pentoxide (P_2O_5); water (H_2O); potassium monoxide (K_2O); sodium oxide (Na_2O); lime or calcium oxide (CaO); magnesia or magnesium oxide (MgO); ferrous oxide (FeO); sesqui-oxide of iron or ferric oxide (Fe_2O_3); alumina (Al_2O_3); and dioxide of manganese (MnO_2).

Among the silicates are included quartz, serpentine, talc, feldspars, mica, hornblende, augite, and chlorite. To the carbonates belong carbonate of lime, chalk, and dolomite, and to the sulphates anhydrite, and gypsum or calcium sulphate.

2. *The Formation of Soil* takes place partly by mechanical or physical, partly by chemical, and partly by organic means.

> "Winds, frosts, and rains; springs, streams, and rivers; tides, waves, and currents; the shivering of the earthquake, and the upheaving of the volcano; the alternate growth and decay of plants and animals; and the universal operations of chemical agency,—are all continually tending to separate, to combine, and to re-arrange the materials composing the crust of the earth." *

The Physical Forces are dependent on temperature for their action. All bodies expand and contract with changes of temperature, and the tension or pressure in different layers of rocks may be influenced so much as to cause fissure, splitting, and cleavage. This is especially the case with rocks containing crystals not belonging to the regular system, for the varying expansion along the different axes loosens the cohesion of the particles. After rainfall in winter the advent of frost causes the water which may have found its way into cracks and crevices to expand with such force as to disintegrate particles, and to loosen large masses of rock, which are thereby made more available for other disintegrating influences. The waters of seas, lakes, and river, likewise, are ever gradually disintegrating and crumbling down the rocks over which they pass, and bearing away the detritus for the formation of alluvial soil elsewhere.

The Chemical Forces make themselves evident in the decomposition of the constituent parts of the rocks through the action of water, by oxidation or deoxidation, and in the changes effected by means of carbonic acid.

---

* Page's "*Introductory Text-book of Geology*," 1871, p. 16.

Water is found in the solid state as water of crystallisation in many salts; when heated the water is driven off, and the salt crumbles into powder. All rocks are porous, although in some cases only to a very slight extent, and are therefore penetrable by water; all, too, are soluble and liable to transformation into other chemical combinations. Absolutely pure water is never found in the earth's crust, that met with being generally impregnated with some other substance like carbonic acid, which assists it in the task of producing modifications of existing combinations. Through the addition of water anhydrite ($CaSO_4$), becomes gypsum ($CaSO_4 + 2H_2O$), and is then soluble in water in the proportion of about 1 in 400, when it occasions *permanent hardness*, which cannot be removed by boiling; calcium cabonate ($CaCO_3$), contained in limestone and chalk, is only soluble in water to the extent of about 1 in 10,000, but readily dissolves in water containing carbonic acid, and then gives rise to the condition known as *temporary hardness*, which may be removed by boiling, when the carbonic acid escapes, and a crust of calcium carbonate is deposited as *fur* in the boiler or kettle.

Most of the elements are found in rocks in a fully oxidised condition, and are therefore incapable of taking up more oxygen. Ferrous oxide (FeO) and ferrous disulphide or iron pyrites (FeS_2) occur, however, in hornblende, augite, chlorite, and many other minerals, and their transformation into oxides is an essential step towards the process of decomposition. Water impregnated with carbonic acid has a powerful action in dissolving silicates which contain alkaline earths and ferrous oxide; carbonate of lime ($CaCO_3$), and ferrous carbonate ($FeCO_3$) in particular are easily soluble, whilst magnesium carbonate ($MgCO_3$) is very difficult of solution.

The products of the combinations vary according to the original composition of the minerals; but in all cases the water taken up is held in chemical combination, forming substances that contain water, and the products of decomposition are divisible into those capable of being carried away elsewhere in solution, and those not removable in such manner. Thus, on the disintegration and decomposition of the various kinds of feldspar ($AlKSi_3O_8$) by the action of the air and of water, a soluble alkali is washed away, and an aluminium silicate is left behind in the form of *clay*. The products of decomposition are mostly alkalies in combination with silica and carbonic acid, and carbonates of lime, magnesia, and ferrous oxide, whilst in nearly every kind of soil is found a greater or less admixture of soluble sulphate of lime. These solutions and soluble salts are capable of acting mutually on each other, so that many different combinations are formed.

The most easily decomposable rocks are those of complicated structure, or which contain minerals liable to be subjected to chemical processes. Thus quartz rock and silicious slate decompose very slowly, whilst rocks rich in feldspars and combinations of iron decompose rapidly; pure lime is difficult of decomposition, but with increase of alumina and iron in its structure this difficulty diminishes. Conglomerates and sandstones disintegrate in proportion to the amount of cohesive or cementing matter contained by them, to the capacity of this for being softened by moisture, transformed, and held in solution, and to the extent to which they alternate with soft bands or layers of clay-slate, marl, &c. Coarse-grained rocks and slate-formations liable to crack and fissure decompose more rapidly than fine-grained or massive rocks, as they afford greater facilities for the penetration of the atmosphere and of meteoric water, and a favourable foothold for lichens, mosses, and other vegetation.

The Organic Agencies.—Without considering infusorial organisms, coral zoophytes, and the operations of earth-worms, which, particularly in tropical countries, play rather an important part, it is essentially the vegetable world that exerts the greatest influence on the formation of soils, both during the period of life of the organisms, and whilst after death they undergo the natural processes of decomposition and decay.

When soils were first formed, only the lowlier forms of vegetable life could maintain an existence. When the period of vitality of these individual organisms was at an end, a process of decomposition set in under the atmospheric agency. The products of the decomposition, in admixture with the existing soil, assisted in the work of decomposing the rocks so as to form more soil, and gradually the evolution of the higher forms of vegetation, and of the various forest trees, took place along with the formation of soil, and consequent on various favourable conditions. This process of decomposition, dependent upon oxygen, moisture, and a certain minimum degree of heat (52° Fahr.), is known as the formation of *humus, leaf-mould, or vegetable mould,* which has been defined by Liebig as "*all organic matter undergoing the process of decomposition.*" When formation of humus or mould from fallen leaves, twigs, branches, undergrowth, and dead timber takes place under full exposure to the atmosphere, water, carbonic acid, and ammonia are produced, and carbon is left behind as mould; $(N + C_{36}H_{22}O_{22}) + O$ of the atmosphere, becomes either $H_2O + CO_2 + NH_3$, or else $H_2O + CO_2 + N$, leaving in either case C_{25} behind as an uncombined remnant.

The normal formation of humus or mould takes place most favourably under ordinary density of leaf-canopy overhead, and when the soil-covering consists of dead leaves, needles, scales, bracts, fallen twigs, &c., together with weeds which do not form woody tissue.

In addition to the better *woodland humus* or *forest mould* the following inferior qualities may also be distinguished[*] :—

Coaly humus, when owing to interruption of the normal process of decomposition it forms a distinct blackish layer above the soil.

Mountain humus or heather mould, when it consists chiefly of heather, heath, whortleberry, along with similar wild growths.

Moorland or acid humus, also formed for the most part of weeds, but when excess of soil-moisture interferes with the normal circulation of air necessary for the process of favourable gradual decomposition.

Dusty humus or dry mould, which crumbles into powder when dried up, and has small hygroscopic power afterwards.

When the decomposition takes place only under partial exposure to the atmosphere, humic acid $(C_{40}H_{12}O_{12})$, other similar acids, and marsh gas (CH_4) are produced, whilst fungoid growths also aid the work of decomposition, attacking first of all albuminoid substances. The humic acid and other similar acids (ulmic, geïn, &c.) produced have a very strong affinity for ammonia, which itself is essential to the nourishment of forest growth, as plants have only a limited power of assimilating the free nitrogen of the air. The older agricultural chemists, headed by Boussingault, asserted that plants could not directly utilise the free nitrogen contained in the air. But of recent years it has been often proved by Hellriegel, Frank, Wilfarth, Ville, and others that this can and does take place, more particularly in the case of the *Leguminosæ*, *e.g.* the Acacia; so long, however, as a supply of nitrogenous food is available in the soil, this capacity, for which the symbiotic aid of a *bacillus* is requisite, is not called into play.[†] The recent researches of Munro, Lawes, and Gilbert in England,[‡] of Frank, Mayer, and Hellriegel in Germany, and of Kostycheff in Russia, following on former discoveries of Schlösing and Müntz, prove the important influences exerted by minute living organisms (microbes) in the process of nitrification or conversion of nitrogen into a nitrate (usually nitrate of lime) before it can enter the tissue of plants. Winogradsky made the important discovery that the nitrifying ferments obtain the carbon needed for their nutrition from the carbonic acid of the carbonate of lime or carbonate of magnesia contained in the soil, thus revealing a hitherto unsuspected attribute of living organisms, the power of directly utilising the carbon of mineral carbonates for the purposes of growth.

---

[*] Weise, "*Leitfaden für den Waldbau*," 1888, page 111.

[†] But see "*Nineteenth Century*," August 1893, p. 260.

[‡] *Vide* two articles, "*The Nitrifying Ferments of the Soil*" and "*The Sources of the Nitrogen of our Leguminous Crops*," in the Journal of the Royal Agricultural Society of England for first quarter of 1892.

Humus condenses gases and atmospheric moisture. It is also warm, partly on account of its retaining well the warmth received from the sunshine and air, and partly because of the development of heat occasioned by the chemical process of decomposition. Hence, whilst mechanically making stiff soils less tenacious and loose soils more binding, it at the same time warms cold soils slightly, and makes sandy land less easily heated and more retentive of moisture.

As the existing supplies of humus are gradually though constantly being used up, fresh supplies become necessary. These are obtained from the annual fall of leaves, twigs, &c., and the growth of mosses and weeds; hence the continuous removal of humus or of dead foliage from woodland tracts must ultimately lead to diminution in the productive capacity of the soil.

Apart from the importance of carbonic acid as one of the chief nutriments of woodland vegetation, it is also of incalculable value in the decomposition of the soil and the preparation of mineral substances for absorption by plants.

The humic acid assists in the work of nutrition by forming solutions of the alkalies (potassium and sodium), which are active in decomposing the mineral constituents of the soil. Senft found that the salt formed by humic acid and ammonia dissolved the silicates of the alkalies and of magnesia, the sulphates of lime and of strontium, and the phosphates of lime and iron.

The higher vegetable organisms also mechanically exert enormous influence on the formation of soil by the disintegrating and cleaving action of their root-systems, which penetrate into the masses of stone and rock forming the base of the soil and subsoil, and later on increase the already produced effects by the decomposition of the woody-fibrous matter of which they are composed.

3. *Classification of Soils as to their Origin and Mineral Composition.*—Soil may be found either remaining on the spot where it was originally formed, as on the slopes of hills and on undulating or high ground protected against having the soil

washed away, or it may have been translated by aqueous agency from where it was formed by decomposition of the parent rock to other and far distant localities. Such translations are daily taking place around us; streams deepen their courses, and rivers their channels; waves and tides weather and wear away the cliffs on which they beat; frosts crumble down the rocky surfaces, and rains wash away the loosened particles; estuaries and lakes are filled with deposits of rubble, breccia, pebbles, sand, loam, and clay, and these sub-aqueous *alluvial deposits* are in course of time made available for sustaining the higher forms of organic life by the natural processes of upheaval and submergence, due to agencies in operation below the crust of the earth.

When the pleistocene group of the tertiary system was being formed, large accumulations of sands, clays, marls, gravels, and boulder-stones embedded in clay without regard to gravity or any assignable laws, were deposited—here in masses, there scattered over wide tracts of land, seldom or never appearing in regular strata—to which the name of *diluvium* or *diluvial drift* was given. Their accumulation was due to the deposit of débris contained in icebergs when the climate became milder, and their appearance as soil took place when the land gradually rose to its present level. These diluvial deposits are found to comprise fragments of all the older rocks, from granite and gneiss up to sandstones, clays, and chalk.

Any attempt at classification of soils according to the nature of the rocks from which they have been formed is of little value. For, *firstly*, one and the same rock does not always yield similar soil (*e.g.*, granite containing much feldspar will decompose quite differently from granite consisting mainly of quartz); *secondly*, the soil from any particular rock depends on the stage of decomposition arrived at (*e.g.*, kaolin has quite different properties from feldspar in the preliminary stages of transformation); and *thirdly*, the products of decomposition are not always retained together (*e.g.*, clay is washed away more easily than sand).

The only practically useful classification is that according to the principal constituents contained in the soil. For the practical purposes of forestry there is no better classification than that of Grebe into:—

SANDY SOILS, containing 75 per cent. or more of disintegrated sand. They occur as sand-drifts, or are the product of the decomposition of sandstones.

Sand consists of about 90 per cent. of sand, and not more than 10 per cent. of clay and other constituents.

Loamy sand consists of about 75–85 per cent. of sand, and 15–25 per cent. of clay and other constituents.

LOAMY SOILS, always more or less coloured with iron, containing 60–70 per cent. of the finest sand and silicious dust, the rest being made up chiefly of clay with less than 5 per cent. of lime and an almost constant quantity (5 per cent.) of hydrated ferric oxide.

Loam consists of, roughly, 60 per cent. of sand and 40 per cent. of clay.

Sandy loam consists of, roughly, 70 per cent. of sand and 30 per cent. of clay.

CLAYEY SOILS, containing 50 per cent. and more of clay. They mostly result from the decomposition of rocks rich in feldspars, augite, and hornblende, of sandstones and conglomerates cemented with clayey cohesive substance, and of the clayey layers and bands occurring in sandstones and lime formations.

Clay consists of about 60–70 per cent. of clay, the rest being made up chiefly of sand and other constituents.

Loamy clay consists of about 50 per cent. of clay and 50 per cent. of sand.

LIMY SOILS, containing not less than 10 per cent. of carbonate of lime. They are the product not only of the limestones proper, but also of other rocks, especially such as contain the feldspar Labrador. Not infrequently the product of the decomposition of limestone rocks yields a loamy rather than a limy soil.

Lime consists of at least 50 per cent. of carbonate of lime, the rest being made up chiefly of clay.

Clayey lime consists of about 40 per cent. of lime and 60 per cent. of clay.

Loamy lime consists of about 30 per cent. of lime and 70 per cent. of loam. It is often rich in carbonate of magnesia, and is then known as *dolomitic lime* or *dolomite*.

Marl consists of 10–20 per cent. of carbonate of lime with 80–90 per cent. of clayey and sandy constituents.

Sandy soils are recognisable by their coarse gritty feeling when moistened and rubbed between finger and thumb. According to the admixture along with the sand it is classed as loamy, marly, ferruginous, or humose. Quartzy sand becomes easily heated and cooled, offers little nutriment to plants, and is not retentive of nutrients, of moisture in particular ; it therefore belongs to the poorer classes of soil, on which trees require a large growing-space to obtain the necessary supplies of food, on which also they soon become interrupted in canopy, are deficient in annual increment, produce seed seldom, and are deficient in reproductive capacity from the stool as well as in natural regeneration from seed. By becoming easily warmed in spring they stimulate to early germination of seed, movement of sap, and flushing of leaves, thereby exposing the young shoots to danger from frost, which is increased by rapid evaporation of moisture and radiation of heat from sandy soil. The more earthy the composition of sandy soils, the better their quality. The treatment to be accorded to any particular species of forest tree on sandy soils depends on its general growth and development; should this be good, natural reproduction under parent standards is safe and easy, but if it be indifferent, the latter mode of regeneration should never be attempted.

When sandy soil is being brought under forest for the first time, the crop should consist principally of Scots pine until from its growth one has had a fair opportunity of judging of the true sylvicultural value of the land and of estimating for what mixed crops it is best adapted.

Clayey soil sticks when placed to the tongue, and when breathed on emits an odour of ammonia; when rubbed between finger and thumb it feels fatty, and when rubbed with the finger-nail it takes a sort of rough polish. The clay is mostly tinged with iron, and varies in colour from grey, through yellow, up to brownish-red. The characteristics of a clay soil are its tenacity, its weak hygroscopic power, and its impermeability and retention of moisture when saturated; it is cold, not easily heated, and has a tendency to become waterlogged. These characteristics are modified by any considerable admixture of sand, iron, lime, or marl, in which case the soils are termed sandy, ferruginous, limy, or marly clays. As the movement of the soil-moisture is slow, nutrients are not apt to be washed out of the layer permeable by the roots of trees, so that clayey soils offer large supplies of mineral food within small space, in consequence of which the requisite individual growing-space is smaller, and the density of the canopy greater, throughout all stages of development of the crop than on sandy soils. Porosity and permeability of subsoil prevent stagnation of the soil-moisture and tendency to the formation of marshes. As a bad conductor of heat, a clayey soil does not stimulate to early germination of seed or the opening of buds in early spring, and though the growth of crops is at first somewhat slow, this improves considerably later on. As the density of the canopy is usually great, and the dead foliage only decomposes slowly on the cold soil with little sunlight playing over the surface, a heavy fall of leaves litters the ground, so that for natural reproduction a good deal of soil-preparation is necessary. Preparatory clearings for this purpose are usually followed by rich production of seed, and the whole operation of regeneration is made easy by the greater amount of shade which the seedlings are here enabled to bear. In copse and coppice, also, the reproductive power is in general greater than on sand.

Limy soil effervesces when nitric acid is dropped on it. Marls and true limes belong to this category, the difference being that in the former the limy constituent is equally admixed throughout each particle of the soil, whilst this is not the case in the latter variety. According as the other components consist of clay, loam, sand, or stones, soils are classed as clayey, loamy, sandy, or stony marls or limes. Such soils are apt to be wanting in depth, but under judicious treatment they very frequently show good growth of timber, as they have a favourable degree of consistency enabling moisture and warmth to be equably distributed throughout, even on steep hillsides, so that the root-system can easily attain its normal development and be assured a plentiful supply of nutrients. When, however, through injudicious treatment the soil has been exposed to insolation, and allowed to become deteriorated, the retention of soil-moisture diminishes; evaporation and the downward flow of water are both greater, the soil soon sets closer; and it becomes shallower, drier, and hotter. These changes take place so rapidly that measures can hardly be taken sylviculturally to remedy the mistakes made. The rewooding of deteriorated limy soil is usually a work requiring great time, patience, and outlay. In many cases excellent results have been obtained by sowing lucern (*Medicago sativa*), and at the same time planting out black pine or sowing beech-nuts, the lucern being left to decompose and improve the soil, instead of being harvested.

On limy soils the retention of an undisturbed soil-covering of dead foliage and humus is a matter of vital importance for their productive capacity; hence, in general, natural reproduction under the parent standards ought to have a preference. As the humus is rapidly formed, soil-preparation is seldom requisite; seed production is usually good, the germinative power high, and the capacity of the seedlings for bearing shade above the average. The greater the proportion of stones or sand in limy soils, the more caution must be exercised in the reproductive measures, as well as in the tending of the woods generally, in the thinnings out, &c. The general energy of growth on well-protected limy soil is also evidenced by strong reproductive capacity in coppice through stool-shoots and stoles, and by the long vitality of the stools.

Loamy soil has more in common with clay than with sand, but does not feel fatty when rubbed between finger and thumb, and takes only a very imperfect polish when rubbed with the finger-nail. Loamy soils are generally characterised by their mildness. They approach more to clays or sands according to the degree of the sandy admixture; but any admixture of lime, either unequally distributed and easily separable as in the case of limy loams, or equally distributed and thoroughly mixed as in the case of marly loams, lends it rather the characteristics of a limy soil. The nature of the subsoil is of special importance in regard to the distribution of moisture throughout heavy soils, though in general they are favourable for sylvicultural operations; the choice of species of trees is usually guided rather by the other factors relating to situation than by those having reference to the mineral composition of the soil. At high elevations the spruce should in general form the ruling species in mixed forests on loamy soils, whilst in lower-lying localities the oak is one of the species which thrives best.

Natural reproduction is easy when once a good seed-year has come round. But the production of a good harvest of seed cannot always be reckoned on, so that whenever there is any danger of the soil becoming slightly deteriorated by insolation during preparatory fellings, or whilst awaiting the advent of a favourable seed-year, artificial assistance, either by means of sowing or planting, is advisable before the deterioration makes itself evident in any decided degree.

In addition to these principal classes of soil, a minor recognition is also made of *humose* and *ferruginous* soils.

Humose soils are such as contain 20 per cent. or more of humus or vegetable mould. Although plainly coloured with mineral particles, they are not infrequently found of such depth that the true mineral soil below cannot be reached by the roots of trees. This is the case in marshes, moors, and peat-bogs formed by the decomposition of grasses, heather, heath, whortleberries, mosses, &c., under partial access of the atmosphere, low temperature, excess of moisture, and impermeable subsoil; usually these are found on sandy soil, resting on clay. The fertile silt deposits left behind after inundations of streams and rivers are often to a very great extent humose in their character.

Humus not only adds depth to the soil, but from its strongly hygroscopic quality condenses atmospheric moisture, whilst as a bad conductor of warmth it acts as a regulator and protects the soil from parting too rapidly with its soil-moisture and becoming parched and dried up; by developing carbonic acid it also assists in the decomposition of the mineral constituents in the soil. It modifies all extremes of physical properties, and though not an absolute necessity for forest growth, yet exerts a powerful influence on it, and is of inestimable value in stimulating the productive capacity of the soil, no matter of what origin the latter be. Humose soils take their main character from their mineral composition; but the beneficial influence they exert on tree-growth is permanent so long as the natural reproduction of humus is not interfered with by interruption of the canopy, &c., since high forest annually gives larger supplies of dead foliage for the formation of vegetable mould than it consumes.

Natural reproduction is often interfered with on humose soils through rank growth of grass and weeds; and even the thriving and the very existence of young plantations of seedlings or small transplants are often endangered from this cause. Where the admixture of humus in the soil forms a high percentage, the tending of woods often requires great care; with an excess of soil-moisture such soils are apt to swell up and form mud, whilst in seasons of drought they run the opposite risk of shrinking and losing consistence. Heather-mould and peat soils do not change so much in appearance, but when they begin to dry up they become so heated that the woodland growth is considerably affected.

Ferruginous soil contains at least 10 to 15 per cent. of ferric oxide or hydrated ferric oxide, and is characterised by its brown-red colour. The general character of sandy soil can become affected by even such small admixtures of ferric oxide as two to five per cent., whilst loamy and clayey soils can often contain much larger percentages without their characteristics becoming perceptibly altered. Thus *moorpan* may contain only about two per cent. of ferric oxide, whilst *iron-band* or *limonite* contains 60 to 70 per cent.; yet both equally hinder the growth of forest trees, except they are broken through so that the subsoil can be reached by the roots, and the circulation of water can take place properly throughout the soil.

If the fertility of soils depended only, or even for the most part, on the mineral richness of the parent rocks, a classification of soils according to their relative strength would be simple; but it is unsafe and incorrect to say more than that clayey soils are usually slow in action in decomposing vegetable matter and yielding food-supplies to tree-growth, that limy soils form humus quickly and stimulate forest growth, and that sandy and loamy soils in general occupy an intermediate position between these two, except when the sand is wanting in a favourable degree of moisture.

4. *The Physical Properties of Soils.*—To these, in a far greater degree than to the mineral composition of any soil, is due its capacity to sustain timber crops, and to yield to them in due proportion the various forms of nutriment requisite for their growth, development, and reproduction. All the

physical properties act and react on each other in determining the quality of any soil for sylvicultural purposes.

(*a.*) *Cohesiveness or Tenacity* is the resistance offered by a soil to instruments used in separating its particles, or to force used in disintegrating them. This property is not alone of importance in relation to air, moisture, and warmth, but also indicates the resistance to be overcome by root-systems in penetrating into and ramifying throughout the soil.

Clay soils have the greatest cohesiveness, sand the least; lime approaches more to the clay, whilst loam resembles rather the sand. An admixture of humus tends to obliterate the differences, making clays and limes less tenacious, and loams and sands more binding. The tendency of soils to expand with moisture, and shrink on parting with it again, is practically proportional to its tenacity. Soils may be classified in this respect as—

Heavy, stiff, or tenacious soils, which fissure and crack deeply when dried up. Clays and clayey loams, limes, and marls belong to this class.

Mild soils, exhibiting superficial cracks when suddenly dried up, but which when nearly dry have the power of retaining the form of clods. They are usually composed of favourable admixtures of clay, sand, and lime, as in loams, sandy loams, and loamy limes.

Light soils, capable of forming clods when moist, but when dry showing a strong tendency to disintegrate, as in the case of loamy sands and sandy marls.

Loose soils, which even when moist have little tendency to form clods. To this class belong the poorer sandy soils.

Shifting soil, liable in a dry condition to be carried away by the wind; sand-drifts and dunes.

In a light soil not deficient in moisture, humus, and mineral nutrients, a maximum of rootlets can be developed, and through these the maximum of timber. Hence one finds the greatest increase in cubic contents, and in particular the greatest increase in height, on alluvial deposits consisting of finely pulverised particles. Looseness of soil, however, if accompanied by deficiency of moisture, is detrimental to the development of plants, especially at the earlier stages of their growth, as such soils part too readily with the water received in the form of rain.

(*b.*) *Relation to Moisture.*—The degree of moisture contained in any soil is one of the principal factors in determining its capacity for sustaining forest growth. No plant can take root, develop, and thrive without a due supply of moisture; it is essential to germination; it is the means by which supplies of food are made available for plant life; it is the source whence are obtained the enormous quantities of water transpired through the foliage; it regulates the soil-temperature; it acts beneficially by making heavy soils somewhat milder, and loose soils somewhat more tenacious. Excess of moisture, however, hinders the normal process of the chemical activity of the soil, tends to clog it, by interfering with the process of formation of humus, with injurious acids and acid solutions, and leads to the formation of marshes and moors; it kills seed, and robs it of a certain amount of germinative power; by supplying the young plant with superfluous nourishment and moisture it leads to disease, especially in the root and stem; being a bad conductor of heat, and not easily warmed, it interferes with the natural activity of the soil, and increases danger from frost.

Capacity for absorbing and retaining meteoric precipitations, and for absorbing hygroscopically and condensing on its surface the aqueous vapour contained in the atmosphere, are dependent on the fineness of the soil-particles; whilst permeability or power of diffusing moisture throughout the soil is proportional to the size of the particles of which the soil is made up. Experiments by Schübler showed that soils may be classed as under:—

Order.	Absorptive Power as to		Power of retaining Moisture.	Power of diffusing Moisture (Permeability).
	Rain-water.	Aqueous Vapour		
1	Lime	Clay	Clay	Sand
2	Clay	Lime	Lime	Loam
3	Loam	Loam	Loam	Lime
4	Sand	Sand	Sand	Clay

The admixture of humus generally found in soils tends here again to modify all hard and fast differences exhibited by the various classes of soil.

According to the average amount of moisture contained in soils during the period when tree-growth is most active, soils are classified by Heyer and Grebe as under (a classification now adopted at all German experimental stations):—

Wet, when, on a clod being lifted up, water flows out without pressure being applied.

Moist, when water falls in drops from a clod on pressure being applied.

Fresh, when, on pressure being applied to a handful of soil, only traces of moisture are left on the hand.

Dry, when on being rubbed it does not resolve into dust. Such soils lose their moisture within a few days after rainfall, and their colour is not much deepened by the moisture retained.

Arid, when on being rubbed it resolves into dust that is carried away by the wind. Traces of rainfall rapidly disappear from such soil, and the slight quantity of moisture it is able to retain does not affect its colour.

The majority of our forest trees—oak, beech, maple, spruce, Scots pine, larch, silver fir—thrive best on a fresh soil; poplars, willows, elm, ash, and hornbeam prefer a moist, and the alder a wet soil; stagnating water is beneficial to no kind of timber. A dry soil is not demanded by any forest tree, but birch, aspen, and Scots pine are able to thrive with less soil-moisture than other species.

Comparative data are not yet available to show the absolute quantities of soil-moisture necessary for the various species of forest trees to enable them to carry on throughout the annual period of vegetation the work of evaporation and transpiration through the foliage. Experience, however, shows that the demands vary as follows:—

Requiring moist soil: Alder, willow, ash.

Requiring fresh to moist soil: Spruce, oak, beech, elm, maple, sycamore, hornbeam, silver fir, larch, chesnut, white alder.

Preferring dry soil: Scots and black pines, mountain ash, aspen.

The sylvicultural qualities of a soil are frequently, to a very great extent, indicated by the nature of the forest weeds that grow upon it. Thus we have characteristic plants as under:—

1. *On wet or boggy soil:*—Bog moss (*Sphagnum*), hair moss (*Polytrichum*), cranberry (*Vaccinium oxycoccos*), bog bilberry (*Vaccinium uliginosum*), marsh cistus or marsh rosemary (*Ledum palustre*), cotton grass (*Eriophorum*), sedges (*Carex*), bulrushes (*Scirpus*), rushes (*Juncus*), the last three in many different species.

2. *On fresh fertile soil, or soil rich in humus:*—Raspberry (*Rubus idæus*), bramble (*Rubus fruticosus*), red foxglove (*Digitalis purpurea*), willow herb (*Epilobium angustifolium*), deadly nightshade (*Atropa belladonna*), balsam (*Impatiens noli-me-tangere*), stinging nettle (*Urtica dioica*), hemp nettle (*Galeopsis tetrahit*), vetches (*Vicia*), and species of clover (*Trifolium*), as well as ferns and broad-leaved grasses of different sorts.

3. *On drier and more sandy soils:*—Heather or ling (*Calluna vulgaris*), heath or bell-heather (*Erica tetralix*), bilberry or whortleberry (*Vaccinium myrtillus*), red whortleberry or cowberry (*Vaccinium vitis idea*), whin, gorse, or furze (*Ulex*), broom (*Spartium scoparium*), greenweed (*Genista*), groundsel and ragwort (*Senecio*), mullein (*Verbascum*), hawkweed (*Hieracium*), spurge (*Euphorbium*),—the last-named genera occurring in various species,—and the narrow-leaved meadow grasses.

The shrubs which occur most frequently on hills and valleys, especially when the soil is fresh, are: Black alder or alder buckthorn (*Rhamnus frangula*), blackthorn or sloe (*Prunus spinosa*), hawthorn (*Cratægus oxyacantha*), spindlewood (*Euonymus europæus*), dogwood (*Cornus sanguinea*), barberry (*Berberis vulgaris*), holly (*Ilex aquifolium*), honeysuckle (*Lonicera periclymenum*), elderberry (*Sambucus*); on drier soil, juniper (*Juniperus vulgaris*), and on sandy soil, buckthorn (*Hippophae rhamnoides*).

(*c.*) *Relation to warmth* is exhibited in the capacity any soil shows for increasing and diminishing its temperature in correspondence with changes in the atmospheric temperature. It has little to do with the specific warmth of the different kinds of soil, but is determinable rather by their colour, and especially by the quantity of moisture contained in them.

Soils, like clay, which retain moisture are cold and inactive, whilst sandy and gravelly soils become easily heated and stimulated, but are liable to the danger of radiating their heat too rapidly, and becoming easily cooled below the freezing point.

Differences in temperature from day to day disappear in our latitudes at about 20 inches below the surface, those from week to week at 40 inches, and those from month to month at about 6½ feet.

(*d.*) *Depth.*—At the surface of the earth the process of decomposition has gone on further than at lower depths. The finest soil is found near the top; and the deeper one goes below the surface, the larger become the stones and breccia undergoing decomposition, till a layer is touched that is practically beyond the reach of decomposing factors, or is of quite a different nature from the soil.

In proportion as a soil is available for the penetration of the root-system and the atmospheric influences, it is termed deep or shallow. The layer of mineral substance available for the roots, or so much of it as is penetrated by the roots, is called the *soil*, whilst whatever is below that is termed the *subsoil*.

Depth of soil is of especial importance in the case of trees like the oak, which, as a rule, do not develop any considerable length of bole if the growth of their tap-root be interfered with. Even trees with shallow root-systems, *e.g.*, beech, hornbeam, birch, aspen, and spruce, thrive better on deep than on shallow soils, as the former generally retain the soil-moisture longer and give it off more gradually, whilst the latter usually suffer from drought or excess of moisture. The disadvantages and drawbacks of shallow soil are more pronounced when the subsoil consists of horizontal layers of plastic clay, of uncleft and impermeable strata, or of ferruginous deposits like moorpan.

Under the instructions for the German experimental stations, forest soils are classified with reference to their depth as follows:—

Very shallow: Up to 6 inches only.
Shallow: From 6 inches to 1 foot.
Medium: From 1 to 2 feet.
Deep: From 2 to 4 feet.
Very deep: Over 4 feet, beyond which depth tree roots seldom penetrate.

Among forest trees the oak makes greatest demands on depth of soil; spruce, birch, and mountain ash make least.

The following table expresses, only, however, in general terms, the depth of soil necessary for the various species of forest trees to thrive normally:—

Up to 1 *foot:* Spruce, aspen, mountain ash, birch, mountain pine.
1 *to* 2 *feet:* Beech, hornbeam, alder, black or Austrian pine, Weymouth pine.
2 *to* 3 *feet:* Scots pine, silver fir, Douglas fir, elm, maple and sycamore, ash, lime, sweet chesnut.
3 *to* 4 *feet:* Oak, larch.

When it is considered that one and the same rock has not always the same composition, that the products of the decomposition of any particular kind of rock often differ in their composition from that of the parent rock and may be endowed with different physical properties, and that these latter are not dependent on the parent rock, the conclusion must be arrived at that no hard and fast deductions can safely be drawn concerning soils from consideration of their geological origin only. Depth, nature of subsoil, relation to moisture, and admixture of humus, are often of equal and even much greater importance as regards the growth of timber crops.

II.—SITUATION IN RELATION TO FOREST GROWTH.

1. *Climate.*—The various kinds of forest trees are unable to thrive, or even to grow at all, everywhere over the surface of the earth. Their capacity for growth and reproduction are limited by certain factors or conditions relating to the distribution of heat and moisture, combined under the expression *climate.* Some require for their development a greater amount of heat and sunshine than others, and thrive where the latter cannot exist; some can not only endure, but prefer, a considerable degree of cold during the non-active season of the year. Some,

with strong power of transpiration through the foliage, require a damp climate; others prefer a dry condition of the air.

(*a.*) *Warmth.*—The climate of any locality is determined by its general geographical position, with special reference to its latitude from the equator, modified, however, by its position with reference to seas, continents, and mountain ranges, to its elevation above the sea-level, and its exposure to winds.

As regards mean annual temperature, Britain is, in consequence of its insular position and of the genial equating influence of that branch of the Gulf Stream which reaches its shores, situated on the same isothermic lines as many parts of Southern Europe. As to warmth in summer it is only on the same isotheric (July) lines as Northern Europe (Baltic), whilst as to average temperature in winter it occupies a position on the same isochimenic (January) lines as Northern Italy, Southern Austria and Turkey.

Temperature falls with elevation above the sea-level and distance from the equator. Experiments at Würzburg showed that the ascent necessary for the reduction of temperature by 1° Fahr. was—

During the month of		During the month of July.	
January	327 feet.		
April	312 „	At 10 a.m.	237 feet.
June	210 „	„ 2 p.m.	207 „
September	243 „	„ 4 „	311 „
December	363 „	„ 10 „	233 „
Average	291 feet.	Average	247 feet.

According to Angot, tree vegetation is later by 14 days for every 333 feet in vertical ascent above the sea-level.

No definite data can be given for the reduction of temperature with progression northwards, as the configuration of the soil exerts such powerful influences in different localities. Low-lying tracts, shut in by hills, are much more liable to frosts than those similarly situated as to latitude and sea-level, but freely open to the action of air-currents. No portion of Britain ascends to the line of perpetual snow.

Heat and light, a form of heat, are essential to the growth and development of forest vegetation, as it is only under their influence that the chlorophyll in the foliage is enabled to decompose the carbonic acid and water in the atmosphere, for the purpose of carrying on the work of assimilation and nourishment. When there is an excess of light, assimilation may be interfered with in the case of lowlier plants; but so far as forest trees are concerned, the more light and air they are allowed to enjoy, the more luxuriantly do they grow and thrive.

In the case of the evergreen conifers the limitation of growth towards the north or on lofty mountainous tracts is often not so much due to the actual degree of cold to which they are exposed, but is principally caused through dry winds on sunny days in winter stimulating transpiration through the leaves at a time when the roots can draw no fresh supplies of moisture from the frost-bound soil. Owing to the loss of moisture contained in the tree the foliage becomes yellow and sickly, the growth impaired and diseased, the leaves fall off, and finally the death of the tree ensues. This phenomenon is most distinctly noticeable after long dry winters with comparatively frequent sunshine.[*]

Experiments are being made to establish the absolute amount of warmth requisite at different localities in order to ensure the normal development of each of the principal species of forest trees, but no definite conclusions have yet been come to. Gayer[†] estimates the requirements as to warmth according to the following scale:—

Requiring most: Elm, sweet chesnut, oak (*Q pedunculata*), black, Austrian, or Corsican pine.
Then: Silver fir, beech, Weymouth pine, oak (*Q. sessiliflora*), Scots pine.
Then: Birch, maple and sycamore, ash, alder, spruce.
Requiring least: Cembran pine, larch, mountain pine.

The demands on warmth naturally to a certain extent limit the different species of trees to definite zones of elevation, which, however, are very much modified by quality of soil, exposure, and local climatic considerations.

Whilst an excess of light, the minor form of warmth, may paralyse the action of chlorophyll in lowly plants, deprivation of the due measure under which assimilation proceeds most favourably exerts an injurious influence on tree-growth. But so far as temperate climates are concerned, forest trees thrive best when they enjoy full exposure to brilliant sunshine.[‡] The relative minima demands of each species on light, sunshine, warmth, and air combined, are easily recognisable through inability of the crop to remain long in close canopy, and through the quick dying off of overshadowed twigs and branches. But such demands vary so much with soil and situation, that we know as little about the absolute amount of light requisite for any species as we do concerning the absolute amount of warmth. From practical experience and observations made on woodland crops growing on soils of only average quality, where their true characteristics[1] are most apparent, British forest trees and acclimatised exotics may be ranged thus :—

---

[*] R. Hartig, "*Lehrbuch der Baumkrankheiten*," 2nd edition, 1889, pp. 104, 261.

[†] "*Der Waldbau*," 3rd edition, p. 20.

[‡] See essay on "*The Enhancement of Increment in Tree-Forest*," &c., pp. 8 and 9.

Light-demanding : Larch, Scots pine ; birch, aspen, willow.
Less-exacting : Mountain, Austrian or Corsican, and Weymouth pines ; oak, ash, chesnut, elm, alder. maple, sycamore, lime.
Shade-bearing : Spruce, Douglas fir, Nordmann's fir, silver fir ; hornbeam, beech.

Whilst woody plants suffer little from frost during winter, late frosts in spring and early frosts in autumn often occasion much damage to the soft shoots. Danger from frost is greater on plains than in hilly tracts, greater on S. and S.E. exposures than on N. and W., greater in valleys and coombs than on ridges and shoulders of hills, greater in localities protected from the wind than in those where currents of air have free play, greater in a dry state of the air than in a moist, greater on fresh soil than on dry, and greater on loose sandy soil than on a stiffer loam. Gayer classifies the forest trees with reference to their liability to suffer from frost as follows :—

Liable : Ash, acacia, sweet chesnut, beech.
Less liable : Oak, silver fir, maple, sycamore, spruce, alder.
Hardy : Lime, hornbeam, elm, birch, larch, aspen, Austrian and Scots pine.

The liability to suffer depends, however, less on the species than on the stage of growth to which the young shoots have advanced. It is greater in weakly than in healthy and vigorous plants; greater too in plants suddenly exposed after having long had the shelter of standards than in those that have been gradually accustomed to the loss of shelter.

(*b*.) *Atmospheric Moisture* is determinable by nearly the same factors as warmth, for it is dependent on the atmospheric temperature. The warmer the air, the greater its capacity for retaining aqueous vapour in suspension; hence all conditions influencing temperature also affect the condition of the atmospheric moisture.

The absolute humidity of the air decreases with increase of latitude, but no rule is traceable in this respect as to relative humidity, for different localities vary as regards the quantity of water available for evaporation.

With elevation above the sea-level the absolute humidity decreases; the relative humidity, however, decreases only in clear, fine weather, but increases at all other times, so that on the average it may be said to increase.

The humidity of the air is dependent on winds. Warm winds blowing across seas or large lakes have a high degree of absolute humidity; in winds from localities without much water increased temperature necessitates decreased relative humidity. In Britain generally the N.W., W., and S.W. winds have the greatest relative humidity; those from the E. are comparatively dry. On the continent of Europe the relative humidity of the air decreases from W. to E.

When atmospheric temperature becomes reduced, aqueous precipitations take place in the form of dew, rain, hail, or snow; hence at high elevations these phenomena will be of more frequent occurrence than in lower localities, whilst at the same time atmospheric disturbances generally are also of greater frequency and violence.

If aqueous precipitations did not take place largely forest growth would be impossible, as enormous quantities of water are annually evaporated through the foliage. These may be roughly estimated from the approximate data determined by v. Hönel*:—

Beech Forest.	Stems per Acre, averaging about	Gallons annually evaporated per Acre during Active Period of Vegetation.	Gallons requisite per Stem per diem.
115 years old -	230	450,000 to 540,000	11·02
50 to 60 years old -	520	260,000	2·20
35 years old -	1,600	70,000	0·22

By comparison of the development of trees of the same species, growing on soils of nearly equal quality, but in localities known to differ greatly as to the relative humidity of the air, it has been concluded that spruce, alder, maple, sycamore, and ash, and in a less degree silver fir, beech, and birch, thrive best in localities where the air has a high degree of relative humidity.

On the continent of Europe the principal tree on the dry sandy North German Plain is the Scots pine. Though it grows well in the damp insular climate of Britain, it does not thrive in the damp climate of Schleswig-Holstein. The spruce on the Harz, the beech on the Solling and Deister, and in a less marked

---

[*] Ramann's "*Forstliche Standortslehre*" in Lorey's "*Handbuch der Forstwissenschaft*," 1886, Vol. I., p. 301.

degree the silver fir in Thuringia and on the highlands of Southern Germany, on account of their great transpiration through the foliage, thrive better in moist localities than in those more exposed to summer drought, and can often be reproduced there by sowing in the open without requiring nurses or parent standards as at lower elevations. In mountainous tracts snow-accumulations are apt to cause branches to snap off, so that brittle woods, like Scots pine, are not the species best adapted for forming forests there, whilst in localities exposed to violent winds shallow-rooted species, particularly spruce, are liable to become windfall.

2. *Aspect* is the exposure towards one or other of the points of the compass. It makes its influence felt chiefly with regard to warmth and soil-moisture. Any situation with southern or south-western aspect is much more exposed to the influence of the hot mid-day and afternoon sun than one facing the north or north-east. The soil in the former case is more apt to deteriorate, through becoming heated and deprived of its moisture by direct insolation, than in the latter; whilst at the same time transpiration through the leaves is stimulated to an excessive extent. On the other hand the limit of elevation to which a tree will ascend is reached sooner on the cool northern aspect. Western aspects are exposed to violent winds and heavy rain-storms; eastern exposures suffer most from frost.

3. *Gradient* is the angle formed by the surface of the soil with the horizontal. On steep slopes the production of timber is less than on those nearer the horizontal, although the soil-surface is actually larger, on account of the soil being generally shallower and less retentive of soil-moisture. Many situations, however, are well adapted for being utilised as woodlands, which are too steep for agricultural operations.

According to Grebe, gradients from 5° to 30° constitute the true home of forest growth. He classifies them from a sylvicultural point of view as:—

Gentle, 5–10°.
Medium, 11–20°.
Steep, 21–30°.
Very steep, 31–45°.
Precipitous, over 45°, which is, however, incapable of sustaining tree growth.

This classification has practically been adopted at the German experimental stations.

4. *Elevation above the Sea-level.*—Recent investigations made in the Bavarian Alps (Brenner Pass, 4,500 to 5,000 feet) have led

to the following conclusions with regard to the effect of vertical elevation on the increment and the shape of forest trees * :—

A. *For individual Trees.*

1. Growth in height diminishes regularly and noticeably.
2. Growth in basal area, or sectional area of the stem at breast-height, does not diminish so rapidly as growth in height.
3. Total increment diminishes gradually.
4. The period of development is prolonged in all of the above three directions (*i.e.* the attainment of maturity is slower).
5. The bole or stem deviates more and more from the shape of the cylinder and approximates towards that of the neiloid.
6. The distribution of the increment over the various portions of the tree increases relatively from above downwards.
7. The form-factor at breast-height (*i.e.* the proportion which the actual volume of the stem bears to a cylinder having the same base) becomes smaller.
8. The coronal development gradually comes lower down, nearer to the ground (*i.e.* the stems become short and stunted).
9. The proportion of branches and brushwood increases (*i.e.* as the stems grow stunted, the coronal development increases relatively).

B. *For whole Crops.*

1. The number of stems per acre increases, but the proportion of those which form the larger girth-classes diminishes.
2. The mean average height of the crops diminishes.
3. The total basal area at breast-height does not diminish so perceptibly as the average height of the crops, but it is made up mostly by units belonging to the smaller classes of stems.
4. The total quantity of wood available as timber or fuel decreases perceptibly; hence the total average annual increment of the mature crop becomes considerably less.
5. The quantity of small branches and brushwood increases.
6. There is a decided tendency towards growth of the trees in groups instead of being equally distributed over the whole area.

---

* S. Honda, "*Ueber den Einfluss der Höhenlage der Gebirge auf die Veränderung der Zuwachses der Waldbäum*," 1892, p. 27.

5. *Configuration of the Soil and the surrounding Country.*—The soils found in valleys, coombs, and dells, and along the base of uplands, is generally deeper, richer, and more productive than that on the ridges and shoulders of hills; but it is more exposed to dangers from frost in consequence of the air, when chilled by radiation, collecting within these low basins closed to the free play of currents of wind. Mountain masses have generally a more uniform standard of soil and situation than ranges of hills, on which the growth of woodlands is greatly influenced by the direction in which the ranges run. When the outermost ridge runs more or less at right-angles to the direction of the prevailing inauspicious winds, the inner ridges are protected; but when the unfavourable winds blow in the direction parallel to the ridges, they follow the windings of the valleys, and work injuriously along both slopes. The evil effects of want of protection from the winds can be easily noted in the vicinity of the sea-coast, or where plantations partially cover exposed hill-sides.

III.—ASSESSMENT OF THE QUALITIES OF SYLVICULTURAL SOILS.

In treating of the description of soils and situations for sylvicultural purposes, it is well that there should be some recognised standard of quality, such as follows:—

No. I. = *very good* in quality.
No. II. = *good* in quality.
No. III. = *average or moderate* in quality.
No. IV. = *inferior* in quality.
No. V. = *poor* in quality.

This scale would, of course, only apply to each of the different species of timber crops *per se*; thus, for example, a soil properly classifiable as No. II. for a crop of Scots pine might only be assessable as No. III. for spruce or silver fir, or might perhaps rank even lower for beech, or oak, or other deciduous forests.

The classification could not, in fact, be in any degree absolute, but merely relative for the one particular species of forest tree.

In assessing the quality of forest soil for the purposes of framing a working-plan, past yield of mature timber is, when available, one of the most practical and ready means of determining the matter. But even when such information is not easily obtainable, the practised eye should find little or no difficulty in forming a tolerably correct and reliable estimate of this important factor towards the formation of a trustworthy plan of operations, without which no extensive forests can possibly be treated in the most rational and remunerative methods.

Complete and reliable yield-tables have not yet been framed for Scotland and England, but the following compilation from German sources may exhibit this mode of assessing the quality of the soil. Exclusive of timber extracted during thinnings, but including branches below 2·8 inches in diameter as well as timber, the total production of pure forest per acre has in Germany been found to be as follows (in cubic feet):—

Age of Forest. Years.	Beech.		Silver Fir.		Spruce.		Scotch Pine.	
	Soil Quality.		Soil Quality.		Soil Quality.		Soil Quality.	
	I.	V.	I.	V.	I.	IV.	I.	V.
20	1,147	244	1,003	172	2,179	502	2,822	817
40	3,555	917	6,665	1,491	6,393	1,835	4,816	1,906
60	6,049	1,663	10,377	3,512	10,650	3,770	6,765	2,680
80	8,313	2,594	12,785	5,303	13,244	5,260	8,156	3,196
100	10,334	3,454	14,276	6,651	14,749	6,264	9,130	—
120	12,054	4,257	15,193	7,568	15,766	7,166	9,804	—

Thus, if a pure forest of spruce, grown in close canopy, normally well stocked, and regularly developed, has yielded about 5,260 cubic feet with a fall of 80 years, the soil is only assessable as of the IV. quality, or *inferior* for spruce; if, however, it may have yielded about 7,921 cubic feet it will be assessable as III. quality or *average*; if about 10,582 cubic feet as II. quality or *good*, by interpolating the II. and III. classes as about the arithmetical mean between the I. and IV., viz.:—

Quality.	I.	II.	III.	IV.
Cubic feet - -	13,244	10,582	7,921	5,260

But a tolerably correct estimate of the quality of the soil can also be obtained in growing crops from the determination of the average mean height of the crop, as the growth in height is more or less proportional to the general quality of the soil for sylvicultural purposes. It may be remarked that in pure woods of equal age, and growing in close canopy of normal density, the stems representing the average height of the crop fall in the class of the dominating, and not the predominating, poles or trees.

In the tables formulated by Grebe,* but which are only approximately correct, and intended chiefly for the middle Saxon forests of Thuringia, the average mean height of timber-crops grown in pure forests is estimated as under :—

Kind of Forest.	Quality of Soil.	Age of Forest in Years, and Average Height in Feet.								
		40.	50.	60.	70.	80.	90.	100.	110.	120.
Beech.	I.	34	48	59	69	78	84	89	92	94
	II.	29	41	50	59	67	73	73	79	81
	III.	24	33	42	49	57	61	64	66	67
	IV.	19	27	33	40	44	48	50	51	52
Spruce.	I.	43	55	69	81	90	97	103	107	109
	II.	37	48	60	69	77	84	88	91	93
	III.	30	40	49	58	64	69	72	75	76
	IV.	23	30	39	45	50	54	57	58	—
	V.	16	21	27	32	36	39	40	—	—
Scots pine.	I.	39	52	65	75	84	90	95	98	99
	II.	36	47	58	67	73	79	83	85	86
	III.	31	41	49	57	62	66	68	70	—
	IV.	25	33	40	45	48	51	53	54	—
	V.	19	25	29	33	36	37	38	—	—

Thus a 60-year-old beech forest of 50 feet in average height would indicate that soil and situation are classifiable as of the II. quality. If the average height of an 80-year-old spruce wood is 60 feet, the soil may be put down as of the III. quality only. If a 55-year-old forest of Scots pine shows a mean average height of 45 feet the soil would also be reckoned as of the III. quality merely. These heights, however, refer to middle Germany, and will probably be found to exceed the average heights attainable in British forests, where planting has hitherto not usually been so close as to stimulate the upward growth to its fullest possible extent from the youthful period of development onwards.

---

* "*Die Betriebs- und Ertragsregelung,*" 2nd edition, 1879, page 114.

ON THE

SELECTION OF SPECIES OF TREES

FOR

WOODLAND CROPS,

AND ON THE

CHOICE OF THE METHOD OF TREATMENT

TO BE ACCORDED TO THEM, TOGETHER WITH THE

EFFECTS OF THE LATTER ON THEIR PRODUCTIVE CAPACITY AND REMUNERATIVENESS.

BY

JOHN NISBET, D.Oec.,

OF THE INDIAN FOREST SERVICE; AUTHOR OF "BRITISH FOREST TREES AND
THEIR SYLVICULTURAL CHARACTERISTICS AND TREATMENT," TRANSLATOR
OF KAUSCHINGER-FURST'S "PROTECTION OF WOODLANDS," ETC.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

1893.

CONTENTS.

ON THE SELECTION OF SPECIES OF TREES FOR WOODLAND CROPS.

Page
Choice of Species of Trees to form the Crop - - - - - 3
Choice of Form and Density of the Crop - - - - - 8
Choice of Method of Formation or of Reproduction of the Crop - - 12
Tending, Clearing, and Weeding of Young Crops - - - - 17
Thinnings in Pole-forest and Young Tree-forest - - - - 20
Partial Clearance in Tree-forest to stimulate the rate of Increment and enhance the technical and monetary Value of the Timber - - 28
Pruning or Removal of Branches - - - - - - 34

ON THE

SELECTION OF SPECIES OF TREES

FOR

WOODLAND CROPS,

AND ON THE

CHOICE OF THE METHOD OF TREATMENT

TO BE ACCORDED TO THEM, TOGETHER WITH THE

EFFECTS OF THE LATTER ON THEIR PRODUCTIVE CAPACITY AND REMUNERATIVENESS.

> "Where any system of management satisfies all reasonable expectations, there can be no object in changing it * * * * * Not infrequently, however, in one and the same forest, certain operations are carried out in a masterly manner, whilst others might be better performed; and observations and experiences made in one locality often remain unknown for a long time in another."—Burckhardt's "*Säen und Pflanzen,*" 1854 (1st edition), Preface.

Choice of Species of Trees to form the Crop.

WHETHER viewed from a purely sylvicultural standpoint relative to the production of the largest quantity of timber of the best quality, or from the financial standpoint relative to the obtaining of the largest annual returns from the capital represented by soil and growing stock, the choice of the species of forest trees forming the crop is of the first importance under all circumstances. Not every given soil and situation will produce any particular kind or assortment of timber; hence the relegation of the various species of woodland trees to the tracts most likely to afford them a suitable, permanent home is one of the first duties of the sylviculturist. When dealing with indigenous species, or such as have become naturalised by long association with our native sylva, nature seldom makes mistakes; and where any self-sown species show good growth, it may in general be accepted that soil and situation are favourable for their cultivation there. But this general rule is of course capable of being followed only in certain cases, and need not be always acted on—

as, for example, when a spontaneous growth of birch or aspen asserts itself on soil from which the owner is entitled to expect better returns and more valuable growth of timber than in the ordinary nature of things these species can possibly promise.

The choice of species is, however, by no means a free one, and there are many soils and situations where it is decidedly limited, or on which it is practically a case of "Hobson's choice." Thus on dry sandy soils no forest tree can compete with the Scots pine, whilst on wet, sour, marshy land the common alder holds equal sway; on peat bogs that have been drained a mixture of Scots and Weymouth pines and birch often offers the most advantageous crop; on low-lying tracts, liable to inundation annually, willows and poplars are best endowed by nature for thriving under these special circumstances; whilst spruce and larch thrive in elevated localities with cool, humid atmosphere, above the zone where deciduous broad-leaved trees could find their natural and congenial habitat.

On many soils and situations a considerable number of species of forest trees find conditions fairly well suited to their general growth; but, in general, one or more of the physical properties determine the elimination of certain species when crops are to be formed for profitable timber-production in contradistinction to ornamental growth and æsthetic effect. Thus want of a sufficiency of soil-moisture may preclude the idea of forming crops of alder, ash, maple, sycamore, and elm, whilst want of atmospheric humidity may militate against the full normal development of beech, hornbeam, spruce, and even silver fir; or where the soil is wanting in depth and penetrability, oak, ash, maples, elm, lime, larch, pine, silver and Douglas firs cannot extend their root-systems so as fully to utilise its nutrient soluble salts. It also happens that the favourable admixture of a certain mineral element in the soil affords special advantages to particular species of trees—as, for instance, the better growth of beech, maples, ash, and black or Austrian pine on soils of a limy composition. And in a certain degree connected with the conditions as to atmospheric humidity and soil-moisture, danger from late frosts in spring, and early frosts in the autumn, can be so great as to preclude the planting out of oak, beech, ash, silver fir, and even spruce without a certain admixture of quick-growing softwoods as protective growth and nurses. Again, where heavy falls of snow are apt to occur, the brittle Scots pine is less able to support the masses of snow and ice accumulating on its loose crown than other more elastic evergreen conifers.

And when one comes to the practical question not only as regards the suitability of soil and situation for any given species, but also as regards their suitability for one particular species above all others, or with a view to the selection of the best species for the formation of mixed crops, which have invaluable advantages over pure crops,* the difficulties connected with the choice become increased. Thus the cultivation of the pedunculate oak, larch, spruce, and silver fir will only prove satisfactory on soils and situations in every respect suited to their normal requirements, whilst over every large woodland tract there are variations in quality of soil and degree of soil-moisture which must be carefully observed and taken advantage of in the formation of mixed crops, instead of attempting to carry out the mixture in anything like a rigid or stencilled manner. No better example of want of prudent consideration or want of knowledge of the natural requirements of any species of forest tree can be given than to point to the mistakes made in the latter half of last century and the beginning of the present with respect to the extensive introductions of the larch into Scotland, which often had their natural result in diseased growth of the trees and disappointed hopes as to the financial returns anticipated.

When soil and situation seem about equally favourable to more than one species, prudential reasons will point to the formation of mixed woods of those species; and considerations relative to conservation of the productive capacity of the soil will naturally lead to a shade-bearing, soil-protecting kind forming the ruling species or matrix, whilst the admixture of subordinate species may be formed either individually or in small groups or patches, to such an extent as promises to be most remunerative until the final clearance of the crop takes place on its ultimately attaining maturity. Of course, when certain species and assortments of timber have a good local market, the ease and readiness with which the timber of particular kinds, or classes, or qualities may be disposed of, will naturally lead the proprietor to their cultivation, even in preference to other species for which the physical qualities of the soil and the local peculiarities of the situation are perhaps in reality better adapted.

Owing to its comparatively low value as timber the beech finds its place as ruling species solely with a view to the conservation of the productive energy of the soil, and need not be cultivated to any greater extent than this consideration demands. But the indirect benefits thus conferred on lightly-foliaged species grown in admixture with it enhance considerably the returns obtainable in quantity, quality, and monetary value from crops of oak, ash, maple and sycamore, elm, pine, and larch formed together with beech.

---

* See essay "*On Mixed Forests, and their Advantages over Pure Forests.*"

Where financial considerations have more weight given to them than those concerning the outturn of timber of special value for certain technical purposes (*e.g.*, oak for ship-building before the days of teak-lined iron steamships) there can be no doubt that for high-forest crops the conifers, and in particular mixed woods of spruce, Douglas fir, silver fir, and pine, yield a much larger outturn in timber and, despite less value per unit of bulk, a higher percentage on the capital involved than can be obtained by the growth of mixed crops of deciduous forest trees. At the same time, on suitable soil coppices of alder, oak, and willow may show financial results far exceeding those obtainable from conifers; but in such cases the quality of the soil and its location are usually very different from those of the areas which have naturally been set apart for sylviculture, owing to their unsuitability for arable or pastural utilisation.

Where all species seem to have about equal chances of thriving, pure forests of Douglas fir, silver fir, and spruce offer the greatest financial advantages, owing to the large quantities of timber produced and the high percentage of it utilisable as timber for technical purposes; oak, ash, elm, and maples come next; then pines, softwoods, and last of all the beech. These are merely rough generalisations, for in each concrete case local climatic conditions exert their influence, and in warm, southern districts oak and other light-demanding species yield more favourable results than the densely-foliaged spruce, which thrives best in the cool, humid atmosphere prevalent within mountain ranges and at high elevations.

In technical value and financial returns obtainable per unit of volume none of our indigenous timbers equals the oak, whilst for furniture and ornamental purposes ash, maples, and red elm approach nearest to it; for the manufacture of agricultural implements, and for similar purposes requiring toughness combined with lightness, ash timber has a value specially its own. Among conifers good sound large-hearted larch is of highest value, whilst pine, spruce, and silver fir vary locally in price. But as spruce and silver fir are so much more productive per acre than other conifers, the large supplies of their timber annually thrown into the continental market may account for its comparatively low prices. The monetary returns available in general from the softwoods depend to a very great extent on local conditions of the timber market, whilst the beech usually yields comparatively poor returns, despite its being the best, most heat-producing kind of fuel obtainable from woodlands.

Whilst the advantages derivable from mixed forests—including conservation of the productive capacity of the soil by the shade-bearing, ruling species; better utilisation of the soil through differences in root-system, and of the light, air, and warmth by the crowns being generally at slightly different levels; protection against insect enemies, fungoid diseases, and damage from inorganic causes, &c.—are attainable to the fullest degree only when the admixture of species occurs in individual stems, the casual differences in the physical properties of the soil can only be fully availed of when admixture takes place in patches or groups varying in extent with the variations in the soil. The general principles guiding the choice of species in mixed crops, apart from the fundamental rule regarding conservation of the soil applicable alike in the formation of pure and of mixed woods, are, broadly stated, that the conditions of soil and situation must suit all the kinds of trees to be intermixed, and that the more or less normal development of each one should be interfered with as little as possible by the others. Hence mixtures of species with similar requirements as to light, or nearly equal capacity for bearing shade, usually recommend themselves only when one species can be utilised so much earlier than the other as to permit of underplanting (*e.g.*, oak, with ash, maples, and elm on good soil), or when, besides producing a greater quantity of timber with higher percentage of technical and consequently of monetary value, other advantages are gained in protection against violent storms or the ravages of insects (*e.g.*, when spruce is mixed with beech and silver fir). Thus on soils and situations suitable for the silver and Douglas firs an admixture of spruce could only endanger the stability of the crop and increase the risk from injurious insects; whilst on soils naturally best suited for spruce the introduction of these other species can be of considerable advantage in the protection afforded against windfall and insects. The formation of mixed forests of Scots pine and larch, so often hitherto formed in Scotland, is one not recommendable, for it is not in conformity with the principles of sylviculture; and practical experience has shown that the theoretical point of view of the matter to be correct.

The most advantageous results are obtainable when a happy choice has been made between light-demanding and shade-bearing species, and when the former retain for a long time the early advantage they gain owing to their more rapid growth during the earliest stages of development. Where it is suited to the soil, beech, owing to the very superior quality of leaf-mould formed by its dead foliage, or hornbeam, yields the best results as matrix from a purely sylvicultural point of view. But in Britain financial considerations undoubtedly deserve greater attention from the land-owning class than the scientific sylvicultural principles that ought to underlie the treatment of the State lands and Crown forests if they were properly administered; hence spruce, silver fir, Douglas fir, and in certain cases black or Austrian pine are the forest trees most deserving of attention. Even though these species may be to a certain, and often to a considerable, extent influenced in their development by the other species of more rapid growth, yet even then they are still capable of yielding timber of good marketable quality and dimensions. Where, however, the interference with their normal development is only comparatively slight, the quality of the timber of these species decidedly gains by admixture.

And when once the choice of species has been made, the proportion which they shall each bear to the total number of plants per acre requires equally careful consideration. The shade-bearing, soil-improving kinds of trees must of course at first form the ruling species numerically; but in course of time they may become so reduced in number as, towards the end of the period fixed for harvesting the ultimate crop, to be in a minority. For example, in crops formed by oak, ash, maples, with perhaps a few softwoods here and there, throughout a matrix of beech, the processes of clearing, thinning, and tending throughout the various stages of growth of the crop will in most cases have led to the elimination of the softwoods between the 30th to 50th years, and of the ash, maples, and other similar woods between the 60th to 80th years; whilst from then onwards the main crop will consist of oaks with just a sufficient proportion of beech to maintain the soil against deterioration. And if the health and vital energy of the oak trees seem to justify their retention as a remunerative crop for a prolonged period of rotation, the beech can be naturally reproduced below them as an underwood, or artificial sowing or underplanting can be resorted to in order to prevent the soil from deteriorating or diminishing in its productive capacity.

Choice of Form and Density of the Crop.

The choice of the most advantageous form of crop to be grown on any woodland soil is determined partly by the species selected for cultivation, partly by the nature of the soil and situation, and partly by the requirements of the land-owner. Should the proprietor have only a limited area under wood and yet desire to obtain, if possible, annual returns, he will naturally favour such methods as yield quick returns and only involve the locking-up of least capital in the way of soil *plus* growing stock. And where bark for tanning or withes for basket-making are at all well paid, on soils that are favourable to the growth of oak and willows these forms of crops are amongst the most renumerative that can be grown. On low wet tracts, too, alder-coppice grown with a rotation of 25 to 30 years gives very excellent results, as the demand for this light wood for cigar-boxes and similar requirements is constant and not likely to be replaced in the immediate future by any other kind of wood or by any substitute of a different nature.

High-forest of trees grown from seed produces absolutely higher monetary returns than ordinary methods of coppice, but owing to the greatly increased capital locked up in the soil and the timber stock from the yearling growth to the mature crop, the financial result is often not in favour of the former. But in consequence of the bulky nature of forest crops, and the heavy costs of transport, local market conditions have such immense influence in determining the remunerativeness of any particular crop, that no general dictum can be laid down on the matter. This much, however, can be asserted, that where woodlands are of considerable extent, mixed coniferous crops worked with a rotation varying from 70 to 100 years are in general most remunerative where the soil is of the average, or below the average, in quality; whilst on soils of the better class, where conifers have a predisposition to suffer from fungoid diseases in the roots and stem, mixed crops of beech with a suitable, large admixture of the nobler species of deciduous trees really offer the safest and the best investments in the long run.

With the endless combinations of the various factors determining the rate of growth of, and the quality of timber produced by woodland crops, the formulation of anything like hard and fast rules must be out of the question. The system of *total clearance and artificial reproduction* is simplest and easiest to carry out. The young growth is not endangered by the gradual removal of any parent standard trees; a freer hand is allowed for the intermixture of subordinate species; and where it pays to undertake it, the grubbing up of the large quantities of fuel represented by the root-systems is a very simple matter. But, on the other hand, there is much greater danger to the young crop from rank growth of weeds, and from insect enemies (*Melolontha* and *Curculionidæ* especially), whilst it is more difficult to recognise and fully consider the variations in the quality of the soil with a view to making the best choice of species for mixed crops. Apart from good soils and species of trees hardy against frost, this method of treatment of the crop should only be adopted, on soils below the average in quality, when special considerations regarding either the soil or the kind of trees to be reproduced render inadvisable the method of *gradual clearance of the crop with simultaneous regeneration under parent standards.* Where the soil is shallow or is apt to be easily heated and to become deteriorated, as is often the case when the percentage of lime contained is great, the first point must be to maintain the soil against the risk of deterioration; hence the form of gradual clearance will be advisable only to so small an extent as to consist merely in the *selection and utilisation of mature trees, individually or in small patches, without materially interrupting the density of the canopy.* Similar treatment will also be necessary in all localities exposed to violent winds, or where the woodland covering is essential for the maintenance of a good permanent supply of moisture in the soil. Wherever sylviculture is practised on a considerable scale coppice-woods are practically confined to mild situations, and to shallow soils unsuited for the normal development of the larger root-systems of trees growing in high forest.

For the production of the more valuable species of timber, growth in high forest is a necessity in the case of conifers, and is also generally advisable in regard to broad-leaved species, although *the composite form* or *copse*, in which light-demanding species of various age-classes form the standards over a coppice-growth of shade-bearing species, is often highly remunerative where any favourable market exists for the produce yielded by the latter.

The density of the crops is a factor which exerts no little influence on their development and ultimate remunerativeness. Crowded woods have practically no greater total enjoyment of light, warmth, atmospheric food, and soil-nutriment than less densely packed crops growing in closed canopy; and as the production of timber is distributed over a smaller number of individual stems, the share which each is capable of receiving is greater than when the total of the available food-supplies has to be divided by the larger number. At the same time in close-canopied, but not crowded woods, the natural selection of the predominating stems to form the future mature crop proceeds more rapidly, as the individuals of more forward growth utilise more than their average share of light, &c., and consequently have a larger annual increment than if the struggle for life and domination were more prolonged, and had to be waged against a larger number of individuals of equal vigour. Where, owing to wide planting, the canopy is not of full normal density, the productive capacity of the soil and the atmosphere is not utilised economically, and a loss in timber takes place, which might easily be avoided. The earlier the young growth forms close canopy, the thinner are the branches formed, and the sooner do they die and drop off; hence a normal density of canopy increases the technical value of timber by the production of clean boles having a high form-factor and approximating more than otherwise would be the case to the cylindrical shape represented by 1·0. All crops intended for timber production should, therefore, be maintained in close canopy till they have entered the pole-forest stage of growth; this is more particularly the case with coniferous species, whose technical and consequently monetary value is dependent, to a considerable extent, on freedom from hard horny branches and knots. And it is of course all the more necessary in the case of shade-bearing species, whose lower branches are longer retentive of life. Where, therefore, the early attainment of full normal canopy can be achieved without special outlay at the time of the young crop being formed, it is undoubtedly of great financial advantage to see that due steps are taken to attain this end. Now, with this object in view it is by no means necessary to crowd plantations; for it is quite sufficient if the twigs and branchlets die off before becoming strong enough to leave snags or rotten ends in the timber, and if they can be displaced by the new annual zones of wood. This period varies in different species of forest trees. The branchlets of the ring-pored broad-leaved species of trees rot much sooner than those of conifers; small twigs of oak or beech snap off through their own weight when they have been dry for two to three years; whilst similar twigs of spruce remain often as snags for 10 to 15 years, and get partially embodied in the stem if not removed. For the production of clean boles, therefore, conifers, and in particular the shade-bearing kinds, should be maintained in close canopy considerably longer than broad-leaved species.

When the normal density of canopy is exceeded,—that is, when young woods are crowded,—the development of the individual stem is injuriously affected, for the crowns are liable to be drawn up so rapidly as to exceed the normal proportion which in well-developed trees should exist between height and girth. Crowded thickets should consequently be weeded and thinned as diligently as possible, even though this may involve considerable outlay; for otherwise the maintenance and prolongation of the individual struggle for supremacy may have a very prejudicial effect on the ultimate remunerativeness of the crop throughout all the later stages of its development.

Where available, normal yield-tables in so far furnish hints regarding the most advantageous density or initial number of plants per acre in pure woods, that they show what the minimum number should be at the various ages for the particular species of tree forming the crop on soil of similar average quality. Supposing, for example, it were found that in spruce forests growing on soils of medium quality the normal and most advantageous degree of density of canopy is attained by about 3,000 stems per acre, it stands to reason that the formation of young crops by planting at a distance of four feet by four feet (2,722 per acre) would entail loss by delaying the formation of canopy, whilst planting at three feet by three feet (4,840 per acre) might, even after allowing for casualties, go to the other disadvantageous extreme of crowding the plantation. Many of the older plantations in Scotland that I have seen were undoubtedly carried out without due consideration being given to the desirability of having canopy formed within 15 to 25 years after the formation of the crop; hence the productive capacity of the soil cannot possibly have been utilised to its fullest extent.

Choice of Method of Formation or of Reproduction of the Crop.

The great advantage derivable from artificial reproduction of forest crops consists in not being in any way dependent on the occurrence of favourable seed-years, as now-a-days seed of all sorts can easily be obtained of good quality from nurserymen in whatever quantity may be desired for sowing out direct or for rearing seedlings and transplants in nurseries. That greater uniformity and regularity of the crop can be obtained artificially than when regeneration takes place naturally, either under parent standards or from seed shed from mature trees flanking the area to be rewooded, hardly requires demonstration. As the methods of sowing or planting are usually simple, and as the operations are confined to a smaller area than when several annual falls are grouped together for gradual clearance, supervision and control are undoubtedly at the same time easier.

Where woodland crops are to be formed for the first time, a choice exists only between sowing and planting, in connection with which—leaving out of sight the special requirements of the various individual species of forest trees—certain general considerations require to be weighed.

With regard to the soil, experience has shown that, on places unfavourable to the early development of young crops, planting is preferable to sowing, owing to the greater sensitiveness and need of protection of young seedlings during the first stages of their existence. And better results are usually obtainable from planting than from sowing, both on very damp, wet, cold, or stiff soils with a tendency to being lifted by frost, and on very loose soils apt to dry up easily, or such as may have become deteriorated superficially through insolation and exposure to exhausting winds, or which are apt to be inundated, &c. Where, owing to rank growth of grass and weeds, young growth has to struggle for its very existence, sowing is the exception, and planting the rule, more especially when the species of trees forming the young crop are of slow initial development. Unfavourable situation with regard to climate, by retarding the growth during the first few years, also weights the balance in favour of planting, especially in raw, damp localities exposed to frost. But on soils that are merely fresh and of a light, mild consistency,—the happy mean between loose and stiff, neither apt to become too heated nor too rapidly cooled, and having no immoderate tendency towards rank growth of weeds,—sowing is principally adopted, as also on rocky, stony outcrops where there is hardly sufficient soil for the proper carrying out of planting operations.

On the continent sowing was formerly most generally practised, and it was not until the introduction on an extensive scale of the method of total clearance with artificial reproduction that the present preference for planting became general abroad. In Scotland the total destruction of the pine woods, originally clothing vast extents of now barren mountain sides, naturally led to the artificial formation of forests wherever the proprietors desired to grow timber. And in the vast majority of cases the conditions of soil and situation—raw northern climate, rank growth of heather, heath, and other weeds, and deterioration of the surface-soil by long exposure to the effects of sun and wind —naturally pointed to planting as the best, and often the only, means of attaining the object in view; for good nursery seedlings, and specially sturdy transplants, had less difficulty in establishing themselves than tender seedlings germinating on the area were exposed to in overcoming the disadvantages with which they had to struggle during the first two or three years of their existence.

Where sowing can take place under the shelter of standards or in the lee of crops nearly mature, it is much more likely to be satisfactory than in the open; but under nearly all circumstances there is usually a good deal of work and outlay required for the filling up of blanks, so that the final cost of the formation of such young crops is not always less than if planting had been carried out over the whole area at the very outset.

Until nursery seedlings or transplants have established themselves in their new abode, there is always a disturbance and a diminution of the activity of the root-system, and this is accentuated by the trimming often requisite even in young plants, and always necessary in older transplants. In this respect sowing certainly has the indisputable advantage over planting of permitting a more natural and uninterrupted development of the root-system, and of effecting a better accommodation of the latter to the nutrient characteristics of the soil. The disturbances occasioned in transplants vary according to the species of tree, the method of planting, and the nature of the soil. Shallow-rooting species with good reproductive capacity establish themselves much more rapidly than deep-rooting species; while on fertile soils the efforts made towards accommodating themselves to the new conditions are more quickly responded to than on soils of merely average or indifferent quality.

By the use of transplants, too, many of the dangers from insect enemies during the first years of growth are avoided, although experience in many different localities has shown that sowings suffer on the whole less from *Curculionidæ* than where plantations are formed with small seedlings.

Comparisons between crops formed by sowing and by planting during the last half century have shown* that in very many cases plantations yield the better results both with regard to height and to girth, whilst as regards total production of timber (inclusive of thinnings) there is no particular difference, although the proportion of branches is larger in plantations owing to the greater initial growing-space enjoyed by each individual stem. Whether or not the advantages as regards dimensions will be maintained by plantations up to the time of their fall as mature crops, is a question for the answering of which no data are yet available for a trustworthy comparison.

---

* See Gayer's "*Waldbau,*" 3rd edition, 1889, pages 383, 384.

On the following point, however, it is well to note the words of so eminent an authority on sylviculture as Professor Gayer of Munich :—

> "But that the rapid initial development of many plantations considerably affects the quality of the timber produced in comparison with what is yielded by crops formed by means of sowing, and that consequently the timber of the former is less able to withstand the attacks of *fungi* later on, is no longer a matter of doubt or question.
>
> "It must, however, be expressly stated that the youthful development of timber crops can afford no reliable indication for the future quality of the mature fall; expectations, anticipations, and suppositions in this respect have no justification, as the whole matter depends more essentially on the later treatment of the crops (whether formed by sowing or by planting) during the operations of thinning out."

In estimating the financial advantages likely to accrue from one or other of these methods of formation of crops, the initial costs, of course, form an important factor; and as planting is, on the whole, more expensive, often very considerably so, than sowing, a choice in favour of the latter method can generally be advised wherever special conditions of soil and climate do not indicate any necessity for planting. Where, however, the inexpensive method of *notching* can be carried out with very young seedlings without any special preparation of the soil, planting operations can frequently be undertaken just as cheaply as or even cheaper than sowing, and in all such exceptional cases planting deserves the preference. But the initial costs of sowing are apt to be miscalculated; and the subsequent filling up of blanks with transplants often brings up the actual costs to more than would have been the initial outlay had planting been chosen at the outset.

Plantations have, in general, notwithstanding the interference and disturbance that takes place before the plants have thoroughly established themselves, a more rapid development in youth, and especially a more energetic growth in height, than young crops resulting from natural regeneration, whilst those formed artificially by sowing occupy a position between these two. These results are explainable by the greater amount of soil-preparation connected with both forms of artificial production and reproduction, and, in the case of plantations, with the larger amount of individual enjoyment of light, air, and warmth, together with a less prolonged struggle with weeds and rank growth of grass.

Natural reproduction is, on the whole, much cheaper than either of the artificial methods, and when properly conducted affords greater protection against frost, drought, and injurious insects; whilst at the same time it maintains the surface-soil subject to the least possible variations in its quality, its covering, and its productive capacity. As greater density of the young crop is usually attained, the thickets grow up remarkably free from branches; but the superior quality of the straight-grained timber is apt to be counterbalanced by the danger to which the young crop is exposed if the poles are allowed to be drawn up too quickly in their mutual struggle for light and air. This struggle for existence is more severe and of longer duration than in the case of crops formed artificially, and especially of plantations; hence careful, oft-repeated clearing and weeding in thickets, and thinnings in pole-forest, are absolutely essential for the avoidance of overcrowding.

For the successful accomplishment of natural regeneration higher demands are made as regards sylvicultural knowledge than when total clearance with artificial reproduction is the method followed; and when seed years are apt to be irregular, it often taxes the ingenuity of the administration of large woodlands to maintain the annual fall of timber without overstepping the limits dictated by prudence with regard to the gradual clearance preliminary to the seed-felling.

It has frequently been objected to natural reproduction that the growth of the young crop is at first much slower than in plantations; but such objectors evidently do not attach sufficient weight to the quantitative, the qualitative, and especially the financial increment which takes place simultaneously on the parent standard trees before the final clearance of the mature crop.*

There is one great drawback of plantations, as compared with crops formed either naturally or by sowing, which seems inherent from the larger amount of growing-space enjoyed by each individual plant, and that is an undeniable tendency to forked or branching growth. This was conclusively proved by the experimental section of the Forestry Department at Munich University in 1885 to 1887; and it has been confirmed for the tropics by my own observations in the extensive teak plantations of Burma. The reason is obvious. As the individual struggle is not at first so great in plantations as in sowings or in natural regenerations, it more frequently happens that one or other of the side-buds throws out a shoot almost equal in size to the axial, true leading-shoot; and as years advance the fork becomes more developed, thereby reducing the value of the timber through spoiling the bole for technical purposes. This tendency may best be observed in coniferous forests, and especially in spruce woods, where three, four, and even five distinct and more or less successful efforts at forked growth are often distinctly recognisable. But the same influences are also at work in other species of trees, tending to dissipate in ramification the energy in growth which it is the object of the sylviculturist to confine to the main object of producing a large, clean bole as straight, flawless, and nearly cylindrical as possible.

---

* See essay "*Concerning the Enhancement of Increment which takes place in* "*Tree-Forest after Heavy Thinnings or Partial Clearance for the purpose of* "*permitting the Timber Crop to have a fuller enjoyment of Light, Air, and* "*Warmth.*"

The necessity for artificial formation of forests in Scotland during the past and the present centuries has already been recognised; but as in very many cases mature crops are now awaiting utilisation and regeneration, the attention of those concerned in the administration of wooded estates may well be called to the later advantages offered by natural reproduction, even although at first the rapid increment in plantations seems to point to this method of regeneration as being the more profitable. Yet there is no reason why a compromise should not be effected, natural reproduction being carried out at first to whatever extent it shows itself easy of success, and artificial assistance being availed of without waiting longer for a further production of seed by the parent standards. The means thus offered for the formation of mixed crops should in reality add to, rather than detract from, the advantages offered by natural regeneration from both a sylvicultural and a financial point of view.

Tending, Clearing, and Weeding of Young Crops.

Many young woodland crops require some protection against dangers arising from inorganic causes, such as frosts, snow, drought, and winds, as well as from those of organic origin due to weeds, fungoid diseases, and insects. When mature crops are reproduced naturally, the requisite degree of shelter can be attained in determining the number of parent standard trees per acre, and in this respect it is to be noted that the various species of forest trees which are light-demanding and of rapid growth at first (*e.g.*, larch, Scots pine, birch, oak, ash, maples,) are naturally less exposed to these dangers than the majority of the shade-bearing kinds (beech, spruce, silver fir). Where crops are formed artificially, the necessity for some protection leads to the planting out of quick-growing, hardy species as nurses, the best kinds being birch and Scots pine, or larch in milder localities, and willows and alder in damp, low-lying tracts.

That rank growth of weeds, whether of grasses or berries, or of woody-fibrous kinds like heather, gorse, whortleberries, and the like, must be cleared away so far as they interfere with the development of the young crop, is of course self-evident, unless the future financial value of the mature crop is to be allowed to run the risk of being considerably prejudiced. And in the same way any outlay for combating the attacks of injurious insects, or for annihilating fungoid diseases that may have gained a foothold, is just as essential for the present and the future well-being of the crop as if it had actually formed a necessary portion of the initial costs of formation; for no matter whether raised naturally, or artificially by sowing or planting, the development of the young growth is essentially dependent on the time when, and the extent to which, canopy becomes formed.

Sometimes seedling growth is so crowded that the crop becomes half choked, and the individual plants are drawn up so attenuatedly as not to be well able to bear their own weight. In the case of the shade-bearing species, they then remain to all appearance almost stationary, although the natural process of selection is much more rapidly effected by light-demanding kinds of trees. But in both classes of species some artificial aid in the struggle is of untold benefit to the survivors from among which the future mature crop is to be formed. The earlier such operations of tending are begun the better; and when young plants are not required for transplanting, the best and cheapest way is to use the shears as much as possible in cutting off weaklings close to the ground. Should this measure, from one cause or another, have been delayed till the young crops are from 10 to 20 years of age, the general reduction in the number of plants must be undertaken very cautiously, as the remaining saplings, bereft of support, are apt to lean over and even to get quite laid after heavy snowfall. It is therefore best to cut narrow lines through the thicket, thus allowing the plants along the edges a chance of developing more rapidly and vigorously than those between the lines.

When the density of the young crop is below the advantageous norm or par, some supplementary species are temporarily necessary, among which the best are the lightly-foliaged, quick-growing Scots pine, larch, birch, and on moister soils aspen, willows, or white alder. By planting these in rows a good distance apart very beneficial effects can be achieved in young crops of backward growth; in particular beech, oak, spruce, and silver fir derive most advantage from their introduction. As this measure should be merely temporary, and not permanent, the removal of such supplementary species should take place only gradually, when indicated by the necessities of the other species forming the main crop.

Until the outlay necessitated remains uncovered by the amount for which the material removed can be disposed of, the operations of removing all species not desired, or all plants of any kind interfering with the better development of the individuals from among which the mature crop will ultimately be formed by a process of natural selection, more or less aided by sylvicultural art, are distinctly classifiable as *weedings and clearings*, the costs of which are properly chargeable to the initial costs of formation of the young crop. The operations called *thinnings* should, on the other hand, really only be reckoned as beginning when the costs are covered by the amounts derivable from the disposal of the material removed. As the costs involved for the weeding and clearing of thickets formed by natural reproduction or by thick sowing are, as a rule, considerably greater than in the case of plantations, this serves to equalise the initial costs of the formation of timber crops. Very few crops are raised from seed without softwoods finding their way in, and effecting a firm foothold on the soil which they often dispute with extreme tenacity, by throwing up stool-shoots and suckers whenever they are cut back. They thus often interfere with the normal development of the young crop only in just a less degree than if they had been allowed to remain where they took root uninvited. The removal of all such intruders is the special aim of *weeding*, whilst *clearing* is undertaken for the removal of all such individuals, of whatever species, forming part of the original crop as may, if allowed to stand longer, by their competition for light and air, detrimentally affect the further development of other individuals which it is desired to encourage or stimulate in energy of growth. So long as the material to be thus removed is gaining in value the object is not to remove as much as one safely can, but rather to confine operations solely to the removal of what is necessary for the well-being of the rest of the crop. The process of clearing must be repeated as often as necessary; but under ordinary circumstances, in fairly populous tracts, or where small poles are required for pea-sticks, hop-growing, and the like, they should cease to be requisite before the crop enters on the period of its most active growth in height as pole-forest. Under such circumstances *thinnings* should begin early, and may often prove highly remunerative.

From the purely financial point of view the results attainable by *weeding and clearing* are commensurate with the probable disadvantages that will probably, and as continental experience has shown will almost invariably accrue, if such cultural measures be neglected. Of these the principal include danger from accumulations of snow and ice, ravages by insects finding a suitable breeding-place in sickly, suppressed, or dominated saplings, and diseases of roots and stems occasioned by fungi like *Trametes*, *Agaricus*, &c. Neglect of these early measures of tending leads in a very short time to dissipation of the vital energy of the crop, to the overstocking of the area with an excessive number of individuals of small technical or financial value, to the crowding out and suppression of more valuable species by kinds of less value, and ultimately to the necessity of clearance and utilisation of the crop at a date much earlier than its ultimate maturity would otherwise have been indicated financially. Wherever reliable data may exist for a comparison of the ultimate returns from two crops on similar soils and situations, both formed by similar methods but subjected to essentially different treatment during the early stages of growth, it will invariably be found that, when a less valuable species or individual has been allowed to interfere with the development of a more valuable, on comparison of the net ultimate returns from the mature crop plus all the intermediate returns from thinnings, capitalised up till the time of utilisation of the two mature falls of timber, the capitalised outlay on weedings and clearings can be proved to have been money very well laid out.

Thinnings in Pole-forest and Young Tree-forest.

Under *thinnings* are understood all operations for the removal of unnecessary species or individuals in timber crops, dating from the time that the outlay thus occasioned is covered by the returns obtained for the material removed, and thence onwards throughout the pole-forest and tree-forest stages of growth, till a commencement is made of the clearances for reproduction or utilisation, or until *partial clearances* are made, after the chief growth in height has been completed, for the more rapid development of large-girthed boles with good top-diameter.

The ultimate quantitative and qualitative outturn from woodland crops depends much more on the proper conduct of the thinnings than on the preliminary operations of weeding and clearing. Practically there is generally a period, of shorter or longer duration, in which the thickets formed from natural reproduction or from sowing are almost impenetrable; and in mixed forests, in which the more valuable subordinate species occur individually, and not in patches, this is often the most critical period for these latter kinds of trees.

The object of thinning any crop is to stimulate and assist its development so that the aim of the proprietor may be attained as completely and as soon as possible, without necessitating any such interruption of the canopy as may prejudice either the growth in height of the crop or the productive capacity of the soil. The crops which stand most in need of thinning, and of a frequent repetition of the operation, are those in which the individuals are all of about the same age, as the natural struggle for individual existence is then more keen and prolonged than where some plants of advance-growth have from the very outset won an advantage. In this process of natural selection four classes of stems become distinguishable, viz., (1) *predominating,* (2) *dominant,* (3) *dominated,* and (4) *suppressed.* As, during the gradual process of death and decay which takes place when stems become suppressed, certain physiological conditions obtain which are extremely favourable to the breeding of insect enemies and the propagation of fungoid diseases, this class of individuals should invariably be removed during thinning operations. By this means a freer circulation of air and a better utilisation of the soil-nutrients are also at the same time effected. To what extent a simultaneous removal of the dominated class should proceed, depends in each case on the concrete factors of soil, situation, species of tree, age of crop, mode of treatment, &c. If the struggle were left to nature unassisted it would be carried out most rapidly on fertile soils, and would be so much prolonged in the case of shade-bearing species of trees on soils of merely average or inferior quality, as to result in overcrowding of the crop throughout the pole-forest and the young tree-forest stages of growth. From the sylvicultural point of view, however, the main objects of care are the timber-trees which it is desired to utilise on their attaining full financial maturity, and any measures that will aid in stimulating them to the speedy attainment of large well-paid dimensions must deserve favourable consideration. Year by year the number of individual stems, from which it is possible that the future mature crop may be formed, becomes diminished; and the removal and the utilisation of all unnecessary stems are not only a means of improving the growth of the predominating and dominant portions of the crop, but are likewise a source of revenue, which should be realised as soon as available, in order to reduce the capital cost of the crop henceforth up till its final clearance. For pure spruce forests on the Harz Mountains, Theodor Hartig found the following total number of stems per acre * :—

At 20 yrs. of age, 9,265,† of which 49°/o might be advantageously removed by thinning.
„ 40 „ 1,249 „ 42 „ „ „ „
„ 60 „ 603 „ 32 „ „ „ „
„ 80 „ 388 „ 21 „ „ „ „
„ 100 „ 282 „ 11 „ „ „ „
„ 120 „ 238 „ 4 „ „ „ „

In mixed forests the practice of thinning must, of course, be conducted on quite a different principle from that obtaining with regard to pure woods, for in order to save a valuable species of tree it may very often be necessary to cut out other species of more energetic growth which may threaten to prejudice its development, or even to endanger its existence.

As regards the influence which the species of tree has on the extent to which thinnings are necessary, Schuberg‡ found in the Black Forest that in 40 to 80-year-old crops, which had been regularly thinned, the following were the results on soils of average quality :—

——	Scots Pine.	Spruce.	Beech.	Silver Fir.
Average number of stems per acre -	545	619	686	864
Absolute individual growing-space, in square feet.	80	70	63	50
Relative individual growing-space -	100	87	79	63

If one groups the chief light-demanding species (pine, larch, oak, ash, maple, birch, &c.) together, and compares them with the various shade-bearing species, it will be found that on the whole these latter only require on the average from 50 to 75 per cent., or one-half to three-quarters, of the growing-space demanded by the former for their proper development as a woodland crop.

The quality of the soil is a very important factor in determining the number of stems per acre, as, owing to the more

---

* See Gayer's "*Waldbau,*" 3rd edition, 1889, page 15.

† This only refers to natural reproduction and sowing; it would of course be much less in the case of plantations. But compare with the above the remarks near the top of page 12.

‡ See Gayer's "*Waldbau,*" 3rd edition, 1889, page 550.

equal strength with which the individual struggle for supremacy is waged on soils of indifferent quality, the growing-space per stem is, up till the 60th to 80th year, often considerably less than on better soils, although in the case of the Scots pine this difference is less marked than in any other species. The practical lesson thereby conveyed is that, on soils just of or below the average in quality, both financial and purely sylvicultural considerations point to the advisability of stimulating, by means of early, oft-repeated, and moderate thinnings, the development of all individuals which it is desired to retain. *Thin early, often, and moderately* is, the golden rule of tending woodlands. Anything approaching interruption of the canopy during the period of most active growth in height must of necessity lead to a further development of the crown at the expense of the length and cleanness of the bole, and must tend consequently to a diminished technical and monetary value of the timber produced.

Between the two extremes of overcrowding and of free individual growing-space there must be in every kind of crop a happy medial point or a *normal density of canopy* at which the quantity and quality of the crop combined attain their maximum. To show the effect which thinning has on the increment of the basal area of the individual stems left forming the crop, the following example may be given. In two different parts of an extensive forest three areas were selected on soil of similar nature and quality, and thinnings were carried out on equal areas in the following degree:—I. *Slight*, only dead and dying poles being removed. II. *Moderate*, all suppressed poles being removed. III. *Heavy*, all dominated poles being removed. Conditions of soil and situation were in each locality as similar as possible, the soil being a fresh, loamy sand throughout. The results of the experiment were tested five years after the thinnings took place.

I.—In the first instance, that of a 37-year-old crop of spruce, raised by planting, the data[*] were:—

Previous to thinning:

On area I., slightly thinned, 2,126 stems per acre, with a total basal area of 242 sq. ft.

On area II., moderately thinned, 2,100 stems per acre, with a total basal area of 251 sq. ft.

On area III., heavily thinned, 2,044 stems per acre, with a total basal area of 234 sq. ft.

---

[*] These and the following data are, by permission, excerpted from Dr. M. Behringer's prize thesis "*Ueber den Einfluss wirthschaftlicher Massregeln auf Zuwachsverhältnisse und Rentabilität der Waldwirthschaft*," 1891, pp. 19 *et seq.*

During the thinning there were removed—

From area I., 502 stems per acre, with a basal area of 9 sq. ft., or about 3¾ per cent. of the total basal area.

From area II., 822 stems per acre, with a basal area of 28 sq. ft., or about 11 per cent. of the total basal area.

From area III., 971 stems per acre, with a basal area of 37 sq. ft., or about 16 per cent. of the total basal area.

In consequence of the thinning *the arithmetical mean diameter at breast-height* (4½ ft.) of the stems left was found to be—

On area I., 5·12 inches;
On area II., 5·68 inches;
On area III., 5·84 inches;

whilst five years later, just before another thinning was to take place, it was found to have increased—

On area I. to 5·48 inches, or an average diametral increment of 0·36 inches per stem.

On area II. to 6·16 inches, or an average diametral increment of 0·48 inches per stem.

On area III. to 6·40 inches, or an average diametral increment of 0·56 inches per stem.

II.—In the other locality, a 36-year-old spruce wood, raised by sowing, the data were :—

Previous to thinning:

On area I., slightly thinned, 7,707 stems per acre, with a total basal area of 219 sq. ft.

On area II., moderately thinned, 7,725 stems per acre, with a total basal area of 235 sq. ft.

On area III., heavily thinned, 7,497 stems per acre, with a total basal area of 220 sq. ft.

The operation of thinning removed—

From area I., 4,736 stems per acre, with a basal area of 29 sq. ft., or about 13 per cent. of the total basal area;

From area II., 5,619 stems per acre, with a basal area of 53 sq. ft., or about 22 per cent. of the total basal area;

From area III., 5,915 stems per acre, with a basal area of 71 sq. ft., or about 32 per cent. of the total basal area;

when *the arithmetical mean diameter at breast-height* of the remaining stems was found to be—

On area I., 3·44 inches;
On area II., 4·00 inches;
On area III., 4·20 inches;

and, *just previous to another thinning five years later*, it had risen—

On area I. to 3·88 inches, or an average diametral increment of 0·44 inches.

On area II., to 4·48 inches, or an average diametral increment of 0·48 inches.

On area III. to 4·72 inches, or an average diametral increment of 0·52 inches.

The actual average increment in basal area was found to be per annum per acre—

I.—*In the plantation*, on area I., 6·6 sq. ft.; on area II., 7·7 sq. ft.; on area III., 8·2 sq. ft.

II.—*In the sowing*, on area I., 8·9 sq. ft.; on area II., 8·7 sq. ft.; on area III., 8·2 sq. ft.

Comparing the average annual increment with the total basal area at the middle of the period of five years, the percentage of annual basal increment was found to be—

In the plantation, on area I., 2·68 per cent.; on area II., 3·22 per cent; on area III., 3·85 per cent.

In the sowing, on area I., 4·27 per cent.; on area II., 4·39 per cent.; on area III., 5·02 per cent.

The obvious conclusions from these data seem to be that in plantations, in which from the very outset each individual plant has a fixed amount of growing-space, the natural process of selection proceeds so much more rapidly than otherwise that—

Firstly, there is less risk of any overcrowding of the leaf-canopy;

Secondly, despite the smaller number of stems per acre, the total basal area (*i.e.* the sum-total of all the stem-superficies at breast-height) is certainly not less than in dense crops raised from seed or by natural regeneration;

Thirdly, a far less percentage of the total number of stems belongs to the dominated and suppressed classes; and

Fourthly, the stimulation of the increment in basal area takes place in accordance with (though it is not necessarily proportional to) the degree to which the thinning takes place.

So long therefore as thinning is not carried to such an extent as to prejudice the energy of growth in young crops that have not yet nearly completed their activity in this direction, free thinning stimulates to the earlier maturity of the crop, and is therefore decidedly advantageous from a financial point of view.[*]

The average percentage of basal increment has been given above, but it must be observed that the figures are subject to modification, for the actual percentage of basal increment is greatest just immediately after the thinning takes place, and it gradually decreases as the crowns close up again towards the termination of the period when another thinning becomes necessary. The physiological explanation of this decrease is that it is owing to the assimilative functions of the lower foliage again becoming weakened through the gradual exclusion of light, air, and warmth.

Experience has shown that the height of timber crops, as well as being practically proportional to the quality of the soil for the species of tree in question, is in all regular crops growing on soils and situations of similar quality, and under similar conditions as to their development, as a rule proportional to their basal area until they have completed their chief growth in height. But when the conditions of development vary, as must be the case when, *cæteris paribus*, certain woods are only slightly thinned, and others moderately, or perhaps even heavily thinned, then the natural relations between height and girth become to a greater or less extent interfered with. The fuller the leaf-canopy remains, the more does the form of the bole approximate to the cylindrical (*i.e.*, the higher the *form-factor* becomes); and the freer the growing-space, the greater is the tendency to conical growth of bole (*i.e.*, the lower the *form-factor* becomes) with simultaneous increase of branch development. Experiments carried out by Dr. Behringer, under the direction of the experimental section of the Forest Branch of Munich University, in beech and Scots pine woods, went to prove[†] that—

> "when thinnings were carried out freely, the development in height was relatively much greater than the diametral increment; and that, at any rate during a certain period in the growth of crops, the heaviest degree of thinning produced the loftiest and the cleanest boles."

---

[*] It may be noted here, that *in tree-forest* a slight thinning removes about 5 per cent. of the basal area of the stems at breast-height in crops of normal density of leaf-canopy, a moderate thinning about 10 per cent., and a heavy thinning about 15 per cent. Where it goes beyond that it becomes in reality a partial clearance, and must be regarded as such. See essay "*On the Enhancement of Increment in Tree-forest, &c.*," page 1.

[†] *Op. cit.*, page 28.

Of course the correctness of this statement, or of any other dictum with regard to most of the operations of practical sylviculture, depends in each case on the nature and condition of the crop in question as to species of tree, age and mode of formation of crop, condition previous to and at time of thinning, nature of soil and situation, &c. But Weise* seems perfectly correct in making the broad generalisation that—

> " when a crop is too thick, increment in height and in girth both suffer to an extent not compensated by the outturn yielded from the greater number of stems; whilst, when it is too thin, the crop remains backward in growth in height."

Experiments made in order to endeavour to formulate a natural law regarding the effect of slight, of moderate, and of heavy thinnings on increment in height, girth, form-factor, and total yield of timber per unit of area, have hitherto failed to have any practical result, but on the whole simply lead one in a general way back to appreciate the wisdom and the practical value of the rule, founded on experience, that " *thinnings should be begun early, carried out moderately, and repeated frequently.*" This does not militate against the correctness of the theory and the practice of partial clearance, after once the chief growth in height is completed, for the purpose of stimulating the trees to rapid increment in girth and to improvement in the shape of the bole.

And practically the same conclusion must be come to when the matter is viewed from the financial standpoint. Although increased returns from material thinned out and profitably disposed of,—regarding them not only as items reducing the capital represented by the growing stock, but also as sums which for correct reckoning must be taken as growing in value at compound interest till the whole mature crop is harvested,—would point to the desirability of heavy thinnings, and would perhaps yield fair results where the market for small timber is favourable, yet the future well-being of the main crop is undoubtedly the main object to be kept in view. And here again experience has shown that considerations affecting both the productive capacity of the soil and the normal development of the crop are most favourably kept in view when the degree to which thinning is carried out at each time of repeating the operation is only moderate, although on soils of better than merely average quality it may well be somewhat freer than on those of a poorer nature.

---

* See " *Chronik,*" 1881, page 25.

Partial Clearance in Tree-forest to stimulate the rate of Increment and enhance the technical and monetary Value of the Timber.

This sylvicultural operation, which is merely the more emphasised expression of the theory of thinning, may be carried out after once the timber crop has passed through the more active period of growth in height, when the advantages offered by increment in girth and in full-woodedness towards the top-end of the bole are not, to anything like the same degree as during any earlier stage of development, prejudiced by such increment being perhaps stimulated at the expense of the rate of growth in height. The removal of up to 15 per cent. of the total basal area when the crop stands in full canopy is still a thinning, whereas the removal of 18 or 20 per cent. is already a partial clearance; the latter operation is practically merely a continuation of the former, only carried out with a freer hand.

Whilst in thinnings the conservation of the productive capacity of the soil is one of the most important objects to receive consideration, in partial clearance its maintenance by means of the tree-crop alone is seldom attainable except on soils of the very best quality; hence underplanting is usually necessary simultaneously with the partial clearance being made.* Throughout the whole of the operations of tending,—the weedings and clearings, the thinnings, and the partial clearances,—the same object is definitely kept in view, viz., the best possible ultimate development of the individual stems forming the chief financial factor in the mature crop. During all these tending operations the more valuable species are not only protected against other species threatening their existence, but efforts are also consistently made to procure for them at the various stages of their development such conditions relative to growing-space, &c. as may produce the greatest amount of long-stemmed, large-girthed, full-wooded timber in the shortest space of time, or, in other words, as may produce the technically and financially most valuable timber at the least cost of production.

In practical forestry this method of partial clearance is naturally confined to a great extent to oak, Scots pine, and larch, as the other light-demanding species of trees in request for ornamental work chiefly, maples, elm, ash, birch, &c., are generally utilised during the later thinnings. When forests, in which the ruling species is silver fir or beech, are to be naturally reproduced, the same stimulation to increment in girth and to improvement in the shape of the bole is practically obtained during the clearances preparatory to and after the seed-felling. In sheltered localities the effects of partial clearance are also very profitable in the case of spruce crops, which, owing to the danger to which this shallow-rooting species is exposed from windfall, are not generally regenerated naturally except under very favourable circumstances as regards protection from winds.

---

* A fuller consideration of this subject is given in the essay "*On the Advantages of Underplanting the light-demanding, thinly-foliaged Species of Forest Trees.*"

When the first partial clearance is made—in oak woods about the 50th to 60th year, in Scots pine between the 30th to 50th year, and in larch about the 30th to 35th year—the fall is confined to all stems of inferior development, or to such as do not give promise of ultimately producing timber of the better class. Later on, in about 10 to 15 years, when the standard trees gradually begin to approach each other in an endeavour to form canopy, the clearance has of course to be repeated, in order that the foliage of the lower branches and within the interior of the crown may not be hindered in their assimilative functions, owing to the decreased measure of light and air to the enjoyment of which they are reduced in anything like close canopy. As in regard to thinnings, there can be no hard and fast rules for the conduct of partial clearances, for so much depends on the quality of the soil and situation; but practically they should be repeated at intervals of about 5 to 10 years at first, and about 10 to 15 years later on. Oak woods treated in this manner about the 50th to 60th year should, according to Gayer,* yield a quantitative annual increment of 3 to 3½ per cent. up till their 100th year, and 2 to 2½ per cent. after that, without taking into consideration the qualitative, technical, and financial increment simultaneously rising more rapidly. At 120 years of age the oak woods treated thus should show about 36 to 48 stems per acre. Larch crops partially cleared from the 30th to 35th year onwards should, on situations naturally adapted for their growth, at 60 to 70 years of age show about 60 to 70 trees per acre with an annual increment of from 3 to 4 per cent. Of course an essential condition for the success of this measure is that the crops are still in active vitality and capable of being stimulated to quantitative and qualitative increments; the operation would be useless in the case of trees already entering on the stage of senile decay. With reference to the relative and the absolute increment on individual stems after partial clearance, Behringer† gives some interesting and instructive data, which are exhibited in tabular form on the two following pages.

---

* *Op. cit.*, pp. 574, 575. † *Op. cit.*, pp. 59, 60.

Stem Sections 13·3 feet apart.	Percentage of Superficial Increment at various sections of the Stem.											
	Spruce.				Scots Pine.				Silver Fir.			
	Before		After		Before		After		Before		After	
	Partial clearance at Age (in Years).				Partial clearance at Age (in Years).				Partial clearance at Age (in Years).			
	58–68.	68–78.	78–88.	88–90.	56–66.	66–76.	76–86.	86–90.	54–64.	64–74.	74–84.	84–90.
At felling height - - -	2·23	1·91	4·44	2·22	2·74	2·19	3·76	3·08	3·85	2·06	4·38	6·26
13·3 feet above felling height -	3·07	1·88	4·66	2·08	1·96	2·64	3·26	3·56	4·17	2·34	2·81	4·10
26·6 „ „ -	3·61	2·16	4·21	2·68	2·90	2·47	3·13	4·19	7·35	2·71	3·30	4·27
40·0 „ „ -	6·35	2·95	5·06	2·63	6·96	2·90	3·83	4·56	15·50	4·36	3·45	4·44
53·3 „ „ -	15·7	5·40	4·88	3·11	12·30	3·54	4·30	3·00	—	10·50	3·50	2·89
66·6 „ „ -	—	13·60	9·30	3·01	—	6·33	7·23	3·60	—	—	—	7·60
Percentage of Increment in Cubic Contents during each period.												
——	4·27	2·61	4·74	2·50	4·47	2·84	3·78	3·72	7·17	3·35	4·10	4·60
Percentage of Superficial Increment at breast-height during the first 10 years after the partial clearance.												
——	—	—	4·43	—	—	—	3·68	—	—	—	4·02	—

Stem Sections 13·3 feet apart.	The Relative Superficial Increment of the various sections, that at felling height for the 10 years previous to the partial clearance being = 1·00.											
	Spruce.				Scots Pine.				Silver Fir.			
	Before		After		Before		After		Before		After	
	Partial clearance at Age (in Years).				Partial clearance at Age (in Years).				Partial clearance at Age (in Years).			
	58–68.	68–78.	78–88.	88–90.	56–66.	66–76.	76–86.	86–90.	54–64	64–74.	74–84.	84–90.
At felling height - -	0·95	**1·00**	2·77	2·01	0·98	**1·00**	2·10	2·35	1·35	**1·00**	2·56	5·27
13·3 feet above felling height -	1·05	0·84	2·46	1·61	0·56	0·90	1·41	2·04	1·19	0·95	1·41	2·63
26·6 „ „ -	0·99	0·80	1·91	1·73	0·63	0·69	1·09	1·91	1·31	0·84	1·30	2·22
40·0 „ „ -	1·00	0·76	1·60	1·32	0·97	0·69	1·17	1·93	1·27	0·91	1·03	1·79
53·3 „ „ -	0·79	0·70	0·95	0·80	0·84	0·54	0·88	0·88	0·72	0·80	1·32	0·84
66·6 „ „ -	0·17	0·33	0·46	0·29	0·46	0·52	0·61	0·52	—	—	0·56	0·57
Annual average Increment in Cubic Contents during each of the different periods.												
In Cubic Feet - -	0·3744	0·4464	1·3752	0·8568	0·8784	0·8064	1·3788	1·8720	0·7308	0·5868	0·9576	1·5156
Relative Increment in Cubic Contents, the volume of the tree during the period of 10 years previous to the partial clearance being = 1·00.												
——	1·15	**1·00**	2·84	1·78	1·09	**1·00**	1·71	2·32	1·25	**1·00**	1·63	2·58

Measurements made at the same time showed that the rate of growth in height had been sensibly diminished in consequence of the greater amount of growing-space afforded after the partial clearance; but as the operation is not performed until after the most active period of growth in height has been completed, this diminution is of comparatively little technical or financial importance.

So far as these experiments go they prove not only that, owing to the larger growing-space, each of the standards was stimulated to produce more than double the increment in cubic contents that it had before the partial clearance took place, but also that whilst in regard to the spruce the enhanced increment culminated within the first decade after this operation, the culmination was delayed in the cases of the Scots pine and the silver fir until the second decade had been entered on, as had also previously been found by König to be the case in beech woods.

That at the same time a qualitative enhancement takes place along with the quantitative increment of the timber is clear from the researches of R. Hartig, who asserts* that in general, without variations according to the species of tree, the quality of the timber grown in the comparatively full enjoyment of light and air is better than that formed under other conditions. This is due to the fact that the extent to which transpiration is carried on through the foliage does not increase *pari passu* with the enhanced rate of increment, as the conductive capacity of the vessels in the new zones of wood is relatively smaller, in consequence of the ligneous deposits within the cellular tissue being thicker and denser. And, further, when underplanting is simultaneously carried out, the undergrowth keeps the soil and the root-system cool, and retards for at least a fortnight the awakening of active vegetation in spring; hence the latter is only entered upon when the weather has become somewhat warmer, and when the assimilative processes can consequently be performed more thoroughly, owing to their taking place under more favourable conditions as to warmth and sunshine.

To determine whether or not in any particular case the method of partial clearance is likely to be remunerative, some practical figures based on past sales are almost necessary, and if these are available the reckoning is easy enough by means of the following formula :—

---

* "*Centralblatt für das gesammte Forstwesen,*" 1888, pp. 8 and 368.

If C = the cubic contents that may be expected from the mature crop with ordinary thinning merely,

V = the value of same per unit of volume at time of the mature fall,

$t_a \ldots\ldots t_q$ = outturn in cubic contents from successive thinnings of the full crop under the ordinary method of treatment from now till maturity,

$v_a \ldots\ldots v_q$ = their monetary values per unit of volume capitalised up till the clearance of mature crop,

and C_1 = the cubic contents that may be expected from the mature crop after partial clearings,

V_1 = the value of the same per unit of volume at time of the mature fall,

$t_\alpha \ldots\ldots t_\zeta$ = outturn in cubic contents from the partial clearances made up till the final clearance of the crop,

$v_\alpha \ldots\ldots v_\zeta$ = their monetary values per unit of volume capitalised up till clearance of mature crop,

then, according as—

$$CV + t_a v_a + \ldots\ldots t_q v_q \overset{<}{\underset{>}{=}} C_1 V_1 + t_\alpha v_\alpha + \ldots\ldots t_\zeta v_\zeta,$$

so must the method of partial clearance be advisable, immaterial, or inadvisable from a purely financial point of view, leaving out of sight any question relative to variations in the technical qualities of the timber produced under the different methods.

When. however, underwood has to be formed, as should almost always be done even on the better classes of soil, the costs thus incurred must be deducted from the reckoning, whilst any return obtainable for the undergrowth at the time of the clearance of the crop, or its value then, if it is to be allowed to remain longer, should of course also be taken into account.

Thus with μ = outlay for producing underwood, capitalised till final clearance of mature crop, and

r = returns obtainable for, or assessable value of, the undergrowth at time of final clearance of mature crop,

the correct formula for estimating the financial prospects of the operations must be—

$$CV + t_a v_a + \ldots. t_q v_q \overset{<}{\underset{>}{=}} C_1 V_1 + t_\alpha v_\alpha + \ldots. t_\zeta v_\zeta - \mu + r.$$

Practical experience in Germany has shown that this method of partial clearance should, under ordinary circumstances, only be adopted on the better classes of soil, and when undergrowth can be formed either naturally or without any considerable outlay.

Pruning or Removal of Branches.

High-forest crops, which have been properly tended and thinned throughout the various stages of their growth, require as a rule no clearance of branches in order to improve the shape of the bole. The cutting and the lopping of branches are both merely measures adopted, often at considerable outlay, to cover the effects of faulty treatment of the crop during the past, and are in general not requisite where trees have gradually been accustomed to a fuller enjoyment of growing-space. In the case of copse or standards over coppice some diminution of the amount of shade cast may be necessary for the well-being of the underwood, and within certain limits this can be effected by thinning the crowns of the standard trees forming the overwood.

Under ordinary circumstances the removal of living branches can only take place to a limited degree, and must in any case (for financial reasons) be confined to the more valuable species of trees. The manner in which the crown is set on the tree is of well-known influence in determining the shape of the bole, as stems with lofty crowns are more full-wooded at the top-end, and approximate more to the cylinder in shape, than such as have deep-seated crowns of foliage. In order that any benefit may be derived from the operation it is necessary that it should be carried out when the trees are in their full energy of growth, and as early as possible before the period fixed for their mature fall.

In many cases, too, where the crowns of the trees are very dense a fillip may be given to their general energy in growth by thinning out some of the branches, so that the foliage remaining may have a larger share of the nutrients extracted by the root-system from the soil. The stimulation thus given to the energy of assimilation is perhaps nowhere more noticeable than in regard to young larch trees, the lower portions of whose foliage may have already been attacked by the larch mining-moth (*Coleophora laricella*).

The removal of dead branches, when carefully conducted, so as to leave no ragged surface likely to offer a favourable germinating-bed to fungoid spores, interferes in no way with the performance of the vital functions of the rest of the tree, but on the contrary, when carried out smoothly and close to the stem, prevents the formation of hard, horny knots in the wood, and consequently enhances the value of the timber, diminishes considerably the danger from fungoid disease, and favours an early and complete cicatrization. It is therefore particularly to be recommended in the case of oak, pine, larch, spruce, and silver fir, whose dead branches are much more apt than in other species to form hard, tough snags, which, being gradually embedded in the stem by the new growth of annual zones of wood, diminish the value of the timber for technical purposes, and thereby affect its market value.

The removal of living branches is, however, a direct interference with the vital condition of the growing tree, and can therefore only be ventured on to a limited extent. Under no circumstances should more than one-third of the total quantity of foliage be removed at one time; practically only about one-fifth of the foliage is generally the extent removed during such operations. Experience has shown* that, even in the case of quick-growing species of trees, the removal of living branches should ordinarily be confined to those that are not over 2½ inches in diameter for conifers or over 4 inches for broad-leaved species of trees, as otherwise the process of cicatrization cannot take place quickly enough to ensure hindrance of the germination of fungoid spores producing disease.

As the broad-leaved species of trees are not so liable as conifers to fungous infection, they usually stand trimming better. With reference to this matter Prof. R. Hartig remarks †:—

> "When branches are removed from a tree, it thereby acquires a predisposition for a number of wound-diseases of an infectious or a non-infectious nature, which may be obviated by timely and effective closure, *i.e.* by antiseptic treatment."

And at another place he adds ‡:—

> "In broad-leaved species, especially the oak, to which my investigations have hitherto been confined, wounds over 4 to 4·8 inches in diameter should not be made."

The species of trees which best stand the removal of green branches are the oak, silver fir, larch, and pines, when they are in energetic growth on favourable soil and situation and have normally developed crowns. Ash, too, can well bear the operation; but as ash and alder both grow with naturally clean stems, pruning is hardly requisite in their case. Whenever the removal of branches takes place to any great extent from oak, maple, sycamore, or elm, the result is that the bole has a tendency to become covered with shoots from the dormant buds, and this of course interferes considerably with the technical and financial value of the stem, and, particularly in the case of the oak, exposes the tree to the danger of becoming "*stag-headed*" or dead in the upper portion of the crown. The soft-woods—birch, willows, and poplars—are not naturally adapted for this kind of treatment, owing to the comparatively slight resistance which their soft, porous wood is able to offer to the development of fungoid disease, as the wound-surfaces afford only too favourable a germinating-bed for the disease-producing spores.

---

* See Ney, "*Die Lehre vom Waldbau,*" 1885, page 300; also Gayer, *op. cit.*, page 584.

† "*Lehrbuch der Baumkrankheiten,*" 2nd edition, 1889, page 15.

‡ *Ditto*, page 226.

In order to diminish the danger from fungoid diseases it is highly recommendable that the wounds should be coated over with some antiseptic substance impervious to moisture. In conifers this takes place naturally by the oozing out of resin; but some coating must be provided artificially in the case of the broad-leaved species. The tree-wax formerly in general demand for the purpose consisted of a mixture of 1·20 parts (by weight) of bees-wax, 2·70 parts of pure resin, 0·60 of turpentine, 0·15 of wood-oil, and 0·15 of suet, all dissolved in warm methylated spirits. Now-a-days, however, the cheaper method of coating over the surfaces with coal-tar, slightly thinned with oil of turpentine, finds general adoption owing to its cheapness. The coating of tar will only bite in to the surface satisfactorily whilst the wood is relatively free from sap, so that it should be administered towards the end of October, immediately after the vital functions of the foliage have been completed, or at any rate some time during the first half of winter. Unless the removal of the branches takes place in autumn or early in winter, the experiments made by Prof. R. Hartig of Munich tend to show that, in addition to the tar not obtaining a good hold on the wound-surface, the condition of the woody tissue is such as to make it less able to resist the penetration of fungoid, disease-producing spores. Practically the same principle holds good here as in regard to the thinning of young tree-forest; for it is much better to thin out branches to a moderate extent only, and then repeat the operation subsequently if necessary, than to endeavour to effect the object in view by one *coup de main*.

The costs involved by the operation vary in each particular case according to the local rate of wages and the handiness of the workmen, the species of trees, the height at and the extent to which the branches are to be removed, &c.; but in Germany it has been found to vary generally in amount from about ¼*d.* to 2*d.* per stem for sawing off the branches and tarring the wound-surfaces.

With regard to the remunerativeness of the removal of branches, Alers, who invented the patent long-handled saws now usually employed in the operation, estimated that if begun in the thirtieth year of age of the crop (coniferous ?), and repeated every five years till the fiftieth year at a cost of about 1¼*d.* per stem, the nett results at 80 years of age, after deducting the various outlays capitalised at compound interest up to that date, would show a profit of 12 per cent. It is impossible to criticise such a vague estimate without examining all the data closely, and ascertaining what the results would be for a fall of timber fixed at 100, 120, or 150 years; but at any rate it is worth remarking that the practical effect of Alers' agitation has been to induce the Prussian Government to undertake regularly the removal of all dead branches in forests grown for the production of valuable timber stems, and not intended merely to be utilised as fuel. From the national-economic point of view this may be advisable in State forests, though for private landowners it is a purely financial question, and local experience will best guide the sylviculturist to a sound judgment about the matter. In accordance with the natural laws of tree-growth, as increment begins at the top and is gradually continued towards the base, the removal of a portion of the foliage diminishes the amount of assimilated nourishment available for structural purposes towards the butt-end of the trunk, and thus leads to improvement in the form-factor of the bole; whilst at the same time, as R. Hartig has shown, the quality of the timber produced improves the more, the less difference there is in the quantitative increment proportionately to the surface of the foliage through which the process of transpiration is carried on. That in consequence of this artificial thinning of the crown the growth in height is stimulated, is a point about which experts have hitherto differed, and which has not yet been determined by authoritative experiments.

Thus while special circumstances have most influence in each particular case relative to the remunerativeness of such measures in private woodlands, the general statement can at any rate be made that the removal of sickly, rotting branches, or of all those infected with parasitic growth of loranthus or mistletoe, or of such as exhibit deformities like twig-clusters (*e.g.*, those caused by *Aecidium elatinum* on silver fir, and called "*witches' brooms*" in Germany), or any other forms of fungoid diseases, is certainly advisable, even at some considerable outlay, in order to prevent the propagation of the disorders and the penetration of diseases into the stem. But at the same time, in coniferous forests it also diminishes the liability of the crops to be damaged by storms or by heavy accumulations of snow and ice. And finally, not its least utility is to be found in the fact that in mixed forests the judicious removal of lower branches often enables a greater density of crop to be maintained for some years longer than can possibly be the case if tending is confined solely to the operations of thinning. For species like ash, maple, and sycamore, which attain maturity at a comparatively early age, this last consideration is a matter of no little sylvicultural importance.

CONCERNING THE

ENHANCEMENT OF INCREMENT

WHICH TAKES PLACE IN

TREE-FOREST

AFTER

HEAVY THINNINGS OR PARTIAL CLEARANCE

FOR THE PURPOSE OF

PERMITTING THE TIMBER CROP TO HAVE A FULLER
ENJOYMENT OF LIGHT, AIR, AND WARMTH.

BY

JOHN NISBET, D:OEC.,

OF THE INDIAN FOREST SERVICE; AUTHOR OF "BRITISH FOREST TREES AND
THEIR SYLVICULTURAL CHARACTERISTICS AND TREATMENT," TRANSLATOR
OF KAUSCHINGER-FURST'S "PROTECTION OF WOODLANDS," ETC.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

1893.

TABLE OF CONTENTS.

THE ENHANCEMENT OF INCREMENT WHICH TAKES PLACE IN TREE-FOREST AFTER HEAVY THINNINGS OR PARTIAL CLEARANCE.

Page
Introduction - - - - - - - - - - 3
The Causes of the Enhanced Increment explained - - - 7
Practical Advantages of the Method of Partial Clearance - - - 10
Rules for the carrying-out of Partial Clearances - - - - 14

CONCERNING THE

ENHANCEMENT OF INCREMENT

WHICH TAKES PLACE IN

TREE-FOREST

AFTER

HEAVY THINNINGS OR PARTIAL CLEARANCE

FOR THE PURPOSE OF

PERMITTING THE TIMBER CROP TO HAVE A FULLER ENJOYMENT
OF LIGHT, AIR, AND WARMTH.

IT is a well-known fact that when trees growing in close canopy are thinned out, or when in the case of old crops approaching maturity a partial clearance is made, the annual increment on each individual stem naturally rises in consequence of the decrease in the number of stems drawing food-supplies and moisture from the soil, and engaging in the struggle for light and air.

In the system of selecting only the largest trees for extraction, in standards over coppice, and in standard trees retained in high forest for a second period of rotation, such increment in growth is certainly attained; but in the following the question to be considered is mainly connected with heavy thinnings or partial clearance made shortly before a crop falls to the axe, in order to stimulate the remaining trees to more energetic growth in girth before the date at which the fall must take place according to the working-plan. It is, in fact, but the continuation of the thinnings that have taken place as measures of tending throughout the whole lifetime of the crop, only it is carried out more freely on account of this being the last thinning that is to be made before the crop attains its full maturity. If less than one-fifth of the total amount of timber on the area be removed the operation may still be considered as a *heavy thinning,* whilst if one-fifth or more of the crop be thus prematurely utilised it must certainly be considered a *partial clearance.*

That such measures undoubtedly do lead to a stimulation of the annual increment is a fact not only abundantly shown by practical experience, but also proved more than half a century ago by the more eminent sylviculturists of Germany, C. Heyer, Th. Hartig, Nördlinger, and others. They showed conclusively that a stimulation of the increment on individual stems took place, as the natural result of all such thinnings as exceeded in degree the natural process of that struggle for existence in which the stronger first overtops and finally suppresses the weaker individual stems, whenever such free thinnings were made in forests growing in close canopy, and at an age not exceeding to any considerable extent the normal periods of rotation under which the species of tree in question was usually grown as a timber crop. Every now and again, however, some champion steps forward to dispute what have long been accepted as facts; but the plausible deductions drawn from his observations are always on closer investigation found to have some flaw. Thus, for example, he may have confined his attention to the bole only, or have neglected to discriminate between the direct effects of the freer enjoyment of light and air, and the adventitious circumstances under which the latter may have taken place, these concrete conditions being at times of such influence as to diminish or even counteract the intended results of the thinning or partial clearance.

There is generally some very easily determinable reason when this latter measure fails to produce more energetic increment. The thinning or partial clearance may, for example, have been carried so far as actually to have interfered with the normal functions of the root-systems and crowns of foliage of the individuals left forming the crop. These *nouveaux riches* may often require some little time to settle down and accustom themselves to their altered circumstances; and the first form in which this makes itself apparent is very frequently rather in the energetic formation of new roots and thicker foliage, which ultimately exert their due influence on the increment of the stem, than in the immediate thickening of the annual rings, or the formation of woody-fibrous tissue. And wherever the other main factors exerting influence on the productive capacity of the soil are not at the same time tended and well provided for. stimulated increment cannot always be expected as the natural result of diminishing the number of trees forming the crop. Thus, for example, care must be taken to prevent deterioration of the soil (where necessary by underplanting) in consequence of insolation and of the drying and exhausting effects of winds, or with regard to the soil-moisture and to the soil-covering of dead foliage requisite for the formation of humus or vegetable mould.

In one case, however, the current increment of the trees may be directly decreased at first in place of stimulated, namely, when the fuller enjoyment of light and air leads in the first instance to abnormal increase in the production of seed in consequence of a tendency to the formation of albuminoid substances in place of carbonic hydrates,* as is especially liable to take place in the case of trees that were already predominating throughout the canopy at the time of the partial clearance being made. And, of course, if the partial clearance be carried too far, the increment on the remaining crop is injuriously affected by the natural consequences resulting from over-exposure of the soil to insolation and the action of winds, and from exposure of the stems themselves to sunburn or scorching of the bole in smooth-barked species, to increased danger from windfall and insects, as also to the greater damage apt to be done during the felling of the stems to be removed, and the grubbing up of their stumps.

Theodor Hartig was the first to assert† that, as the direct and immediate consequence of freer enjoyment of light and air, without reference to the species of tree, stimulated increment on each individual tree invariably took place, though subject to the influence of the other factors determining the rate of growth. When any apparent exceptions to this rule take place, they are neither ascribable to differences in the species of trees, nor to differences in respect of soil and situation, but are solely due to one or more of the above-indicated causes. Species of timber, soil, and situation certainly exert their influence as regards the extent to which increment may take place, but are not of themselves the direct or prime cause; there is, however, good reason to believe that deciduous trees are enabled by nature to avail themselves of the direct and immediate increment to a somewhat greater extent than the coniferous trees which retain their foliage throughout the whole year.

The enhanced increment need not assume the form of broader annual zones of woody-fibrous tissue along the bole, but may, and very often does, at first take the shape of considerable changes throughout the root-system and the crown of foliage, primarily and undoubtedly due to the freer enjoyment of light, air, and warmth; this paves the way for the succeeding form of enhanced increment, due to these changes in and increment of the assimilative organs, which makes itself more readily distinguishable throughout the stem and branches.

---

* Riniker, "*Der Zuwachsgang in Fichten-und Buchenbeständen,*" 1886, page 30.

† "*Lehrbuch für Förster,*" 1861, Vol. I., page 105.

The extent to which the annual increment thus becomes enhanced varies in any particular species of tree according to the individual stem, its age and reproductive capacity, the soil, situation, and exposure on which the crop grows, the density of the canopy throughout the crop, and the development of the crown of foliage borne by the individual stem. The younger and sturdier the tree, the better developed its crown, the more favourable soil and situation may be to the thriving of the particular species of tree, and the denser or more crowded the wood, so much the more likely is the influence of the thinning or partial clearance to be readily observable. That the extent to which it is perceptible varies in the different species of our forest trees has been above indicated and really requires no explanation. Thus, for example, oak, pine, and larch that have been grown in pure forests, in which there is a strong tendency for the trees to thin themselves naturally to such an extent as to make the canopy loose, if not broken, and to allow of each individual stem forming a larger crown than is usual in the case of shade-bearing species like beech, spruce, and silver fir, can hardly be expected to derive so much benefit as the latter from an artificial diminution of the number of stems per acre. In many such cases indeed this natural thinning, especially when the oak, larch, and pine are approaching the time of maturity of the crop, may have proceeded so far that any further artificial clearance might lead to diminution instead of enhancement of the increment of the remaining stems in consequence of deterioration of the soil, unless underplanting take place at the same time in order to improve, or at any rate protect, its productive capacity. As it is well expressed by Gayer,* the founder of the modern school of scientific sylviculture,—

> "Whenever the partial clearance is likely to lead to interruption of the canopy of the crop, it should only be carried out when the productive capacity of the soil is such as promises in all its essential factors to supply continuously the increased demands made in consequence of greater energy in the crown of foliage (transpiration and assimilation), *i.e.*, that the soil in question is fertile, or that care may be taken to stimulate the productive capacity of the soil in some suitable way at the proper time. This can only take place through the maintenance of a good layer of humus and the careful retention of soil-moisture, and consequently in many cases only by means of *underplanting* in order to protect the soil against sun and wind."

But in the case of the shade-bearing species, beech, spruce, and silver fir, which (except in cases of accident) remain in dense canopy throughout their whole period of growth, right up till their normal maturity, the effects of the freer enjoyment of light, air, and warmth procured for the individual stems by heavy thinning, or by partial clearance when they approach the prescribed time of fall, are often during the first year marked by a two-fold to ten-fold increase in the breadth of the annual zone of woody-fibrous tissue.[*] This stimulation of increment can also in the case of these trees be attained with a far less degree of clearance, so that, with proper care, there need be small danger of the soil being in any way injuriously affected owing to the partial and temporary interruption of the canopy to a slight degree, a fact easily explained by the lesser absolute measure of light and air enjoyed by these shade-bearing species when grown in canopy of normal density.

---

* "*Waldbau,*" 3rd edition, 1889, page 571.

Thus, whilst the laws regulating the increment in all species of forest trees are substantially constant, the extent to which the enhancement of increment takes place after partial clearance has, so far as observations have yet been recorded, been found to be practically in the inverse ratio to the requirements of any particular species in regard to light and freedom of crown.

THE CAUSES OF THE ENHANCED INCREMENT EXPLAINED.

Various causes have been assigned to the effects produced in enhanced increment after partial clearance.[†] Th. Hartig considered it to be due rather to the utilisation of reserves of productive matter collected and stored up in the stem whilst it stood in close canopy, than to any increased assimilation in direct consequence of the increase in foliage that takes place when the individual tree obtains a larger growing space; whilst Nördlinger, on the other hand, ascribed the enhancement in increment to the increase in the foliage, but laid particular stress upon what he considered the fact, that the enhancement was not so much the direct result of the increase in the mass of foliage as of the stimulated assimilative activity of the leaves and needles, with simultaneous temporary increase in the productive capacity of the soil.

The correct explanation as to the enhanced increment is probably to be found in a combination of these views, for it is much more than probable that the utilisation of the reserves of productive matter (principally starch in various forms) is most likely greatly favoured by the more active, assimilation of nutrients whenever the increase in the foliage takes places, and there is no reason why they should not be directly connected with the formation of the fuller crown of foliage immediately after the partial clearance has been made. It is still an open question how such reserves of nutrients are formed, how they circulate throughout the tree, and how they are finally utilised, although their existence in the parenchym-cells of woody-fibrous plants is just as well known as that of similar reserves in orchids, perennial tuberous plants, &c. The recent destruction of forests in Bavaria by the Nun moth has given Professor R. Hartig of Munich special opportunities of studying a part of this subject, particularly in regard to the spruce,* and he has conclusively proved that this species of tree has far less reserve supplies of nutrients than the Scots pine. In general, as is well known, such reserve supplies are far more plentiful in the broad-leaved deciduous species of trees than in conifers, and larger in the deciduous larch than in the evergreen conifers. All the changes that take place in trees prior to the commencement of the assimilative activity in spring are ascribable to these nutrient reserves,—the flowering of hazel, alder, and willow, the swelling of the buds and the flushing of the young leaves, the formation of rootlets; in fact, all the similar phenomena previous to the development of independent cambial activity must be ascribed to these reserve supplies of starchy and nitrogenous nutrients. The supply of reserves is usually sufficient to maintain vegetation for one complete year, and often for longer; indeed in many cases it amounts to 7 or 8 per cent. of the total weight of 30-year-old timber crops. Diminution of light and foliage consequent on limitation of growing-space must interfere with the utilisation of these reserve nutrients, and it is quite logical and reasonable to expect that with more growing-space and a consequent increase of foliage these reserves should be largely drawn upon and utilised.

---

[*] Grasmann, "*Beitrag zur Lehre vom Lichtungszuwachs*," 1890, page 9.

[†] Grasmann, *op. cit.*, page 4.

That any stimulation of the productive capacity of the soil takes place in consequence of the freer penetration of the atmosphere and the stimulus given to the production of humus or vegetable mould is doubtful, or even more than doubtful, for unless the canopy still remains comparatively dense the soil soon becomes covered with forest weeds, which often really consume the mould and tend to exhaust the soil in place of allowing the timber crop to have the full benefit of the humus.

The true physiological cause of the enhancement in increment after heavy thinnings or partial clearance of crops of trees approaching maturity is to be found in the stimulus to the formation of starchy matter afforded by insolation, the degree of activity of the assimilative organs being dependent on the purity or brilliancy of the rays of light, as the decomposition of the carbonic acid in the atmosphere can only take place when the waves of light attain a certain length. Whilst a crop is growing in full canopy the assimilative activity of the foliage forming the lower portion of the crown is extremely small owing to the low quality of the diffused light which is alone available, but when the canopy is opened up to a sufficient extent these portions of the lower foliage, which have been practically inactive, or may perhaps even have been existing on the work done by the upper leaves or needles, reassume their normal assimilative functions and help to enhance the general increment of the tree. And besides this increased assimilative power of the foliage, the consequent increased formation of new leaves and needles is undoubtedly of enormous influence in maintaining and increasing the general enhancement of increment throughout the stem. As remarked by König,* the direct result of the free enjoyment of light and warmth leads to the better and more energetic development of the leading-shoots, the strengthening of twigs, and the formation of twigs from buds that would otherwise most probably have remained dormant.

---

* See "*Forstlich-naturwissenschaftliche Zeitschrift*" for January, February, and March 1892.

The enhanced increment continues until the crop once more forms close canopy, but if again stimulated by a repetition of the thinning out or partial clearance this may—if not accompanied by underplanting—be carried on so far as to involve deterioration of the soil to such an extent that the beneficial influence of light and warmth on the crown is cancelled by the diminished activity of the root-system, involving consequently decreased supplies of moisture and of mineral nutrients for conveyance to the assimilative organs.

The simultaneous underplanting of crops subjected to this system of partial clearance, and especially of those of light-demanding species of trees,—oak, ash, maple, larch, and Scots pine,—has an undoubtedly stimulating result in effecting and maintaining the enhancement of increment after partial clearance, and is of particular interest from the financial point of view. The influences exerted by soil and situation, and by the age of the crop, exhibit themselves rather with regard to the extent of the enhancement in increment than to its production and continuance; for unless the individual trees are already far past their normal maturity, and already show signs of the loss of energy in growth due to a foreshadowing of the approach of senile decay, such also receive a fillip from admission to larger growing-space and freer enjoyment of light and warmth. When, however, the vital energies of the trees are weakened by age or disease, normal enhancement of increment must not be looked for, the circulation of the sap throughout the stem being already to a greater or less extent interfered with, whilst the root-system is also unfitted to discharge the extra duties it is called upon to perform. Trees that are not very far past the period at which their current annual increment has culminated, as well as such as have not yet attained the culminating point, are, however, unquestionably stimulated to livelier energy, which manifests itself in enhanced increment. But in practice this system of partial clearance for the speedy formation of the more valuable assortments of timber is seldom applicable to very young woods, or to crops that are already much older than the usual periods of rotation. It generally finds proper scope only in mature crops of high forest and in those approaching maturity; and in these cases the age of the crop has little influence on the length of time throughout which the enhancement of increment is maintained, this being determined rather by the length of time which it takes the crop to form close canopy once more. The nature of the development of the crown is, however, of greater importance than the age of the crop, for if the previous thinnings have been neglected, and the canopy has been allowed to remain so dense that the woods are crowded, it often happens that on receiving increased growing-space the trees with their weakly crowns are unable to avail themselves of the advantages thereby offered, and exhibit, as may so often be seen in the case of oaks, a tendency to the development of dormant buds, which leads to "*stag-headedness*" or death of the crown, and malformation of the bole.

---

* "*Ueber Lichtungszuwachs, insbesondere der Buche,*" 1886, page 7.

PRACTICAL ADVANTAGES OF THE METHOD OF PARTIAL CLEARANCE.

From the practical sylvicultural and the financial points of view such heavy thinnings or partial clearances should not be made until after the crop in question has completed its chief growth in height.

Along with the other advantages of natural reproduction under parent standards, the rapid increment in timber, as well as in the technical and financial value of the latter, which takes place after partial clearances for the purpose of regeneration, has drawn considerable attention to this method as a system of treatment of woods, even when their artificial reproduction,—as in the case of oak, maple, larch,—may generally be considered more advisable than natural regeneration. The favourable returns received from the gradual clearance of parent standards in the case of natural reproduction of beech, and of silver fir in particular, as well as the financial advantages that accrue ultimately from the partial clearance and underplanting of indifferent crops of oak, larch, and Scots pine when they approach maturity, have to a great extent dispelled the prejudices that existed against the system in the minds of some as being entirely inconsistent with the natural course of things, and have won for it recognition as a method of treatment worthy of adoption wherever circumstances admit of its practice. There seems little doubt that in the near future it will be carried out to a much greater extent than at present, as it combines most of the advantages of standards over coppice with decided sylvicultural and financial advantages of its own. Thus, for example, by means of this method of partial clearance the larger and more valuable assortment of stems can be produced in a shorter time, *i.e.* at a less cost, whilst instead of a high forest of normal density composed of nearly mature trees, with an average annual increment long past their point of culmination and gradually sinking, an equal and often a greater annual increment per acre is attainable after the partial clearance, paying as well, and often better, than if the full crop had been allowed to attain maturity, besides yielding substantial returns from the timber prematurely utilised. When in natural reproduction the gradual clearance of the parent standards is effected, it is in no way inconsistent with what has been above said if, before the formation of the young crop, the average annual increment of the standards is below that of normal high forest reproduced by total clearance and sowing or planting, seeing that from the time the young crop may be considered formed onwards the enhanced increment on the more or less isolated standards is undoubtedly more favourable financially than when total clearance is followed by artificial reproduction.

That portion of the fixed capital which is represented by the growing crop is considerably reduced by means of the partial clearance, and the money thus derived as intermediate returns can be otherwise utilised in order to yield interest for itself, whilst the material left standing increases in the percentage it affords. Thus, if the partial clearance amounts to one-fifth, or one-third, or one-half of the total crop in close canopy, it has been satisfactorily proved by several authorities* that the enhanced increment on the area partially cleared at least equals, and often exceeds, the total previous current annual increment, notwithstanding the diminution in the number of trees thereafter forming the crop.

The financial advantages derivable are thus summarised by Grasmann† :—

(1.) The larger and better-paid assortments of timber can be produced in shorter time, and therefore more cheaply, by this method.

(2.) Instead of the full crop, with small annual increment on a larger number of individual stems, three factors are favourably introduced and combined, viz. :—

(i.) Good intermediate returns are available, capable of producing interest for themselves.

(ii.) The enhanced annual increment on the remaining crop equals, and often exceeds, that produced by the full crop previous to its partial clearance.

(iii.) The naturally or artificially produced young crop under the parent standards often practically equals in increment a young crop formed artificially by sowing or planting.

What Loudon says‡ of the oak may be applied to all our forest trees grown as crops with a view to remunerative returns from the capital invested :—

> " *The age at which oak timber ought to be felled, with a view to profit*, must depend on the soil and climate in which the tree is grown, as well as on other circumstances. Whenever the tree has arrived at that period of its growth, that the annual increase does not amount in value to the marketable interest of the money which, at the time, the tree would produce if cut down, then it would appear more profitable to cut it down than to let it stand."

Whilst this is perfectly correct for each individual tree grown in the comparatively isolated positions that timber trees usually occupied in Britain at the time the above was written, it in no way precludes the possibility, which in fact we know from actual experience to be the case, that when the current annual increment per acre has sunk below the point up to which it is not unprofitable to allow a crop to remain in the full normal canopy of its species, it can be stimulated and rendered more profitable, often very considerably so, by the above-indicated method of partial clearance with a view to the earlier production of valuable stems of large girth. In regular high forest, with natural reproduction, the time of regeneration is often, in order to attain good boles of valuable dimensions, prolonged till after the period when energy for the formation of seed or the natural reproductive capacity is already somewhat weakened. By means of partial clearances, however, the regeneration can be favoured during the chief natural seed-producing period of growth, whilst, at the same time, as good dimensions of timber may be obtainable as in the regular high forest, and in a more profitable manner. Thus, for example, in the reproduction of spruce in sheltered localities, where windfall is not likely to occur, and where the period of reproduction may be taken to be usually about 100 years, if partial clearance be made about the 70th year, during the time of the most active production of seed, the financial position of soil plus crop during the succeeding 30 years will almost, beyond question or doubt, be much more favourable than if the crop had been allowed to stand as regular high forest till the full period of rotation originally fixed in the working-plan had been attained; for it is almost certain that the partially cleared crop will contain a relatively higher number of boles of valuable assortments than would have developed themselves under the system of regular high forest. And what is said here in regard to spruce is still more applicable in regard to the other two great shade-bearing species, the silver fir and the beech. The whole system is in fact merely a modification of and improvement on the old system of natural reproduction under parent standards; but whilst in the latter case the seed fellings (partial clearances) before and during the time of seeding, and the gradual clearances after the formation of the young crop took place mainly with the object of effecting natural regeneration, the partial clearances under the new method are made with the distinctly avowed intention of stimulating the standard crop to enhancement of the annual increment, and to the yield of more favourable returns from the capital represented by soil and growing crop. In the former case formation of a young crop was the motive, and enhanced increment on the parent standards the effect; in the latter, enhancement of annual increment is the object, and simultaneous natural reproduction of shade-bearing species the result of this sylvicultural operation.

---

* Wagener, "*Der Waldbau und seine Fortbildung*," 1884, page 208; Kraft, *Beitrage zur forstlichen Zuwachsrechnung*," 1885, pages 99 *et seq.*

† *Op. cit.*, page 11.

‡ "*Arboretum et Fruticetum Britannicum*," 1838, Vol. III., page 1809.

RULES FOR THE CARRYING-OUT OF PARTIAL CLEARANCES.

With the light-demanding species of trees, when they are not grown in mixed forests along with shade-bearing species, underplanting is almost a necessity after heavy thinnings or partial clearances, in order to maintain the productive capacity of the soil. The manner in which this method of treatment is applied to the various chief species of our light-demanding forest trees—oak, pine, and larch—is as follows:—

Oak.—When pure forests of oak have passed through the regular processes of thinning, and approach the time for partial clearance taking place, their canopy is in general somewhat light and thin, although perhaps not broken, and the undergrowth is usually already beginning to form canopy for itself below the older crop. To avoid the formation of twigs and shoots from the dormant buds along the stem, often leading to "*stag-headedness,*" the partial clearance should not be made by one fall, but is better attained by one or two heavy thinnings conducted to the extent deemed advisable for each individual crop. The time at which it should take place is also dependent on the special circumstances of each crop, but chiefly with regard to the time of underplanting and the development of the undergrowth, the energy of growth of the trees, and the nature of the soil and situation. As, however, the efficacy of this method of treatment is all the more apparent the earlier it can be begun, the thinnings should, if possible, be commenced about the 40th to 60th year, being at first confined to the young stems of backward growth, and to such as are never likely to attain good marketable shape. The oftener the thinnings can be repeated at short intervals the better, as any sudden exposure of the boles should be carefully avoided.

About 10 or 15 years after these preliminary operations have been begun, the main partial clearance will in most cases seem advisable, for by that time the crop should be in a state of active increment, due to the favourable influences of the undergrowth and the previous thinnings. Here, again, as also whenever further partial clearances are considered necessary later on, the fall is in the first instance confined to trees that have been damaged by organic or inorganic agencies, or that do not continue to yield satisfactory increment; and not until all such unremunerative material has been removed should sound trees in energetic growth be cut out.

When the main partial clearance has taken place about the 70th year, and has been followed by minor gradual clearances at intervals of five years at first, then of 10, and later on of 15, the preliminary yield or intermediate returns thus obtained amount according to Kraft,* respectively to about 288 to 628 cubic feet, then to 720 to 1,080 cubic feet, and ultimately to 1,800 cubic feet per acre, inclusive of brushwood. Past experience seems, according to Gayer,† to justify the hope that by this method of treatment the same dimensions of bole can be attained in about 120 years as are obtainable in pure forests worked with a rotation of 200 to 240 years, provided that up till about the 100th year the rate of increment has been maintained at 3 to 3½ per cent., and after that at 2 to 2½ per cent., conditions which are quite conformable with the actual results obtained on suitable soils. The crop of oak then ultimately harvested numbers about 36 to 48 stems per acre, which on good soil yield valuable and well-paid assortments of timber.‡ Where soil and situation are good enough to fulfil the demands made on them, there can be little doubt that this system of underplanting with a shade-bearing species, and partially clearing the main crop from time to time, is the one best calculated to produce timber of highest value for technical purposes, and to yield the most favourable returns financially from the capital represented by the soil, together with the growing crop.

Scots Pine.—For the practice of this method a good deep soil is necessary, as it differs essentially from the custom, common on poorer qualities of soil, of thinning out crops during their 20th to 50th year of age and underplanting them with spruce or other suitable shade-bearing species. In the latter case they are often allowed to grow on to maturity without any further thinning or interruption of the canopy to speak of; but though they continue to improve in growth and form, this is due to the beneficial influence of the undergrowth both on the soil and the standards. As a good formation of the crown is requisite for

---

* "*Aus dem Walde,*" Vol. IX., page 80.

† *Op. cit.*, page 574.

‡ The following passage from Loudon's work already quoted (page 1809) is interesting, although not quite intelligible as regards "*the largest scantlings*" being produced at 180 years of age, though if "*larger*" be read in place of "*the largest*" the statement readily becomes intelligible:—

"A writer in the *Gardener's Magazine* states that Mr. Larkin, an eminent purveyor of timber for ship-building, stated, when examined before the East India Shipping Committee, that, in situations the most favourable for ship timber (the Weald of Kent, for example), the most profitable time to cut oak was at 90 years old; as, though the largest scantlings were produced at 130 years' growth, the increase in the 40 additional years did not pay ½ per cent. (*Gard. Mag.*, Vol. XI., p. 690.)"

Scots pine in order to enable it to continue for a long time in active energetic increment, thinnings should be made towards the end of the pole-forest stage of growth, and afterwards repeated whenever there seems any danger of the crowns interfering with each other. Underplanting should also be here carried out as soon as the thinnings have taken place with a view to the formation of good individual crowns. By this means, in place of having a pure forest formed, according to Weise's Yield-Tables,[*] on soil of average quality at 80 years of age by 317 stems per acre, having a mean average girth of 29 inches at breast-height, which would only be attained by about 40 per cent. or 127 stems, with a form factor of 0·45 and a current annual increment of only 44 cubic feet per acre, it can hardly be doubted that a smaller number of trees with enhanced increment and the finer dimensions of stem effected by the comparatively rapid thickening of the bole at the top end must yield more favourable financial returns on the capital invested in timber production. Reliable comparative data are, however, unfortunately not yet available.

Larch.—In regard to general treatment by partial clearance with a view to the speedy production of large-girthed timber the larch has much in common with the oak; but the underplanting may sometimes take place more advantageously with the silver fir than the beech. So far as experience goes this method of treatment is well adapted to the cultivation of the larch on good, deep soil, and is most satisfactory when the partial clearance and underplanting takes place as early as the 25th to 30th year. When the previous tending of the plantations has been good and the thinnings have been regularly made, the main partial clearance can be heavier than in the case of the oak, so that subsequent clearances are often almost unnecessary. On good soil from 60 to 70 trees per acre remain to form the final yield of the standard crop; and wherever soil and situation are at all suitable for the growth of larch, 60 or 70-year-old crops can often yield an increment of 3 to 4 per cent. up till that age, when they already show good marketable dimensions.

As the beech is not in favour or demand as a timber-tree of large dimensions, this method is only apt to find any practical application with the spruce and the silver fir among shade-bearing species; and as they show many points of similarity, they may be considered together. Where, however, there is any likelihood of windfall or damage from storms, this method is totally unsuited for the spruce.

---

[*] “*Yield-Tables for the Scotch Pine*,” translated by W. Schlich, Ph.D., 1888, pages 18 and 19.

Spruce and Silver Fir.—The way for partial clearance should be paved by preliminary operations carried out about the 25th to 30th year in such a manner as to let the predominating poles have a clear space of 2 or 2½ feet around the crowns, these favoured individuals standing about 15 to 17 feet apart, and all the rest of the crop being thinned out in the ordinary manner customary in pure forests without interruption of canopy. During the 30th to 50th year, when the influence of this measure has made itself apparent in the re-formation of close canopy, the main partial clearance takes place in somewhat similar manner, the stems between the favoured individuals being freely thinned so as to permit of the formation of an undergrowth either naturally, or where necessary artificially, wherever the minor portion of the crop is of itself insufficient to protect the productive capacity of the soil. When the favoured stems have at breast-height a girth of about 36 to 40 inches, which they should attain between the 60th to 80th year, the marketable trees can then be gradually cleared away on the same principle.

Another method, practised in the neighbourhood of Salzburg in Western Austria in mixed forests consisting of spruce, silver fir, and beech, consists in carrying out the thinnings once every 10 years after the crop has attained 30 years of age, and making them heavier each time the operation is repeated, until the main partial clearance is made about the 60th or 70th year, leaving 120 to 160 stems per acre, all of them conifers and in energetic growth. Under such a crop natural reproduction can easily be effected, so that about 20 years later the standard trees are of large marketable dimensions, whilst the young growth may vary from 5 to 15 feet in height. On the removal of the standards the blanks thus formed in the new crop can easily be filled up artificially, and may be advantageously utilised for the formation of mixed forests by the introduction of other species.

Actual measurements of crops thus treated are not yet available for comparison with the yield-tables published for pure forests, but the approximate data already given may be contrasted favourably with the more accurate information contained in these latter. According to v. Baur, pure forests of spruce of 120 years in age and growing on good soil have 288 stems per acre, the mean girth of which at breast-height is 39 inches, but this is only attained or exceeded by about 40 per cent. or

115 stems; the mean average stems have also been found to have a form-factor of 0·48, which is undoubtedly lower than that of stems treated by the method of partial clearance. Again, according to Lorey, the silver fir, when grown in pure forest on good soil, yields 200 stems per acre with a mean girth of about 52 inches at breast-height, which also is only attained by about 40 per cent. or 80 stems per acre.

As has already above been pointed out, this method of partial clearance with the distinct object of stimulating the remaining crop to the speedy development of the larger and better-paid assortments of timber cannot be successfully attempted with regard to any species of tree when once its natural energy of growth has practically abated to any considerable extent, or on the poorer classes of soil; but wherever the trees are still capable of stimulation in respect to increment, and the productive capacity of the soil can be easily safeguarded against deterioration, the method has decided practical advantages which should strongly recommend themselves to the woodland proprietors of Britain, where sylvicultural operations on any extensive scale should only be conducted on strictly financial principles.

REPORT

ON

FOREST ADMINISTRATION

IN

GERMANY.

BY

G. A. HIGHT,

DEPUTY CONSERVATOR OF FORESTS, BOMBAY.

CALCUTTA:
OFFICE OF THE SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA.
1894.

CALCUTTA
GOVERNMENT OF INDIA CENTRAL PRINTING OFFICE,
8, HASTINGS STREET

REPORT
ON
FOREST ADMINISTRATION
IN
GERMANY.

When conversing with Continental forest officers, I have often been struck by the similarity of the questions with which they have to deal with those which present themselves to an Indian forest officer. True it is that in some branches of forest science India has little in common with Europe, and more particularly is this so in the department of forestry proper, using that term in its restricted sense as equivalent to the German "Waldbau." The Indian forester cares little about knowing that oaks thrive on red sandstone, that beeches are favoured by lime, and require guarded thinning; nor is he much interested in the merits and demerits, real or supposed, of different patterns of axes, or in various fashions of boundary marks. But directly we pass from these details, which can generally be safely entrusted to the experience of the local executive officials, to the broader domain of scientific forestry, it is surprising how the conditions of one country resemble those of the other. To the curious I can recommend a perusal of Danckelmann's "Ablösung und Regelung der Waldgrundgerechtigkeiten," particularly section 6 of the first volume, relating to the history of forest rights, in the early and middle ages, much of which reads almost as if it were written for India of the present day, except for a certain difference in terminology; what we in India call *privileges*, the author calls by their proper name, *rights*. Instances where the science of one country is applicable directly to the other might be multiplied indefinitely, and are as interesting as they are instructive, the latter more especially because Germany is in forest matters several centuries ahead of us in India, and it is therefore to Germany that we must turn to correct our errors of the past, to learn what to follow and what to avoid in the future. The Government of India have fully recognized this by offering Indian forest officers when on furlough facilities for studying forestry on the Continent. It is, in my opinion, much to be regretted that so few have taken advantage of this offer. I can only assure my brother officers in India, that apart from the service which they render Government, they will find it a most agreeable way of spending a portion of their furlough, and will certainly derive both pleasure and advantage from interchange of ideas with such an accomplished race of men as the German forest officers. For me there could be no thought of undergoing *instruction* in forestry; I have been familiar with the German forests since my youth, and hope I shall not be thought presumptuous for saying that there is little of the school instruction from which I could now derive much profit. All I desired was to report to Government upon a few questions on which I thought a report would be of interest. This explanation is necessary because the object of my application appears to have been somewhat misunderstood out of India. The Government of India in their Despatch No. 88, of December 27th last, directed me to *visit and report* upon the German forests, and this was in accordance with my application.

The subjects selected by me for report were three:

I. Forest police and relations of forest officers to the Civil authorities and the people.

II. Grazing in Government forests.

III. Forest organization, with special reference to rotations and the modern school of German forestry.

To these was added by the Conservator of Forests, S. C., Bombay—

IV. Rights and privileges in the German forests.

I will commence by giving a list of the States which I have visited and of the gentlemen who have assisted me in my enquiries:—

1. *Prussia*—

Oberforstmeister W. Weise, Director of the Forest Academy in Münden.

Forstmeister Ohnesorge. Lauterberg in the Hartz Mountains.

Forstrath Frese Erfurt.

Oberförster Pfannstiel Schwarza-Schleusingen.

2. *Kingdom of Saxony.*

The late Geheimer Oberforstrath Yudeich, Director of the Forest Academy at Tharand.

Professor Dr. Neumeister, Professor at the Forest Academy at Tharand.

Professor Dr. Krutsch, Librarian at the Forest Academy at Tharand.

3. *Grand Duchy of Saxe Weimar.*
   His Excellency Landforstmeister v. Strauch.
   Oberforstrath Dr. Stötzer, Director of the Forest School at Eisenach.
   Oberförster Trautvetter Eisenach.
4. *Duchy of Saxe-Coburg-Gotha.*
   Oberforstrath Rausch.
5. *Duchy of Anhalt-Dessau.*
   Fostrath Reuss.

There were many other States which I could easily have visited, but I thought these were enough. There could be no use in multiplying details of every different State; it would have added to the expense and have made it very difficult for me to write an intelligibly clear report. Indeed I soon found out that it was much better to confine myself mainly to the larger countries like Prussia and Saxony, not that the conditions of smaller States were less instructive, but because I found the *principles* were very much the same everywhere and were easier to study comprehensively in the larger field. With the mass of information which I obtained, my greatest difficulty *has been to* avoid multiplying details.

I will now take the different subjects in order:—

I. Forest police and relations of forest officers to the Civil authorities and the people.

I will introduce my remarks with a sketch of the organization of the Forest Department in Prussia which may serve as a model. It is divided into two branches, superior and subordinate. For the superior Forest Service, as for all the higher services, including the army and even the navy, the very severe school test called the *Abiturium* is required. After passing this, the candidate goes through a course of professional training which to those accustomed to English conditions seems little less than terrible; it is partly practical in a district with a Government forest officer, partly theoretical, two years at a forest academy and one year at an university. Besides the forest sciences, several subsidiary subjects have to be taken up; zoology, botany, chemistry, mathematics, political economy, and the elements of jurisprudence, the last two subjects being — in my opinion, rightly — considered of special importance. Two examinations have to be passed at an interval of two years. The training is carried on entirely at the expense of the candidate, who has generally arrived at the age of about 28 before he passes his second examination. After this he is qualified for Government employment, but still has to wait for a vacancy before he receives a post. The appointments are given to the candidates in order of seniority, and a man is generally 40 before he obtains a permanent position as Oberförster. In the meantime, however, he may be employed in temporary and acting posts, and draw pay, but the number of such posts is so small that the candidate generally has to wait very long before obtaining one of them. It is especially in the periodical valuation surveys of the Government forests, and in the construction of working-plans, that employment is generally found for such candidates.

For the lower branch the training is scarcely less severe but it is exclusively practical. These men, too, receive their appointments after due qualification in order of seniority as "Försters".

The unit of administration is the *Oberförsterei*, which may be said to contain on an average about 7,000 to 8,000 acres of forest area, about corresponding in extent therefore to an Indian taluka. The establishment considered sufficient for such a district in Germany, is, in addition to the Oberförster and his personal assistant, about six foresters and perhaps two or three lower officials drawn from the wood-cutter class and answering to our forest guards.

. The steps between the Oberförster and Government are very numerous. First comes the "*Forstrath*", who has, on an average, about 7 Oberförstereis under him. The next grade is the *Oberforstmeister* and after him again the *Landforstmeister*. Highest of all is the *Oberlandforstmeister*, who has supreme charge of all the forests of the country. No doubt there exist good reasons for this apparently excessive multiplication of the grades of higher officials. All executive officials, particularly the Försters, are entrusted with police powers, similar to those which we hold in India. They can arrest offenders, confiscate stolen property, search houses, etc.

In Germany, as in every country where there are State forests, the interests of Government and those of the agricultural inhabitants of forest villages occasionally come into conflict, and that there should be so little friction between the forest officials and the public in Germany is due to the excellent tact and judgment shown by the officials themselves in the discharge of their duties, and to the support which Government are able to give to a Department of such exceptional efficiency. I have generally found that the Oberförster is the most popular man of his country side. The long and severe course of professional training which a Prussian forest officer has to undergo tends to develop the habits of self-restraint so necessary to those who hold responsible public positions. Moreover, the superior officers are recruited from the better classes of society; it stands to reason that a man who has to continue more or less in training until he is nearly 40, must possess some means of his own; a large number are men of good family, and all possess a very high general education. When once the years of apprenticeship are over, the German Oberförster certainly has a very comfortable berth, with his large and convenient official residence, his farm-yard and fields around him, entire control of the shooting, and the prestige and local influence which belong to his official position. In a country where officers are not perpetually taking leave, as in India, there is little occasion for moving them, and it not unfrequently happens that an officer remains stationed in one place during his whole life.

Of great interest to us in India is the system of punishing forest offences. I do not mean graver offences—large thefts and frauds which are subject to the criminal law of the country, but little petty thefts of head-loads of wood, cattle-trespass, etc., which are not worth taking into Court, and yet must be repressed. A principle is accepted in Germany, which appears to me to be very sound, namely, that no executive officer may inflict a punishment. The Oberförster's function is that of a public prosecutor, who *proposes* a punishment, afterwards to be ratified by an independent judicial authority.

When a forest officer in the course of his inspection meets with a person committing a forest offence, he makes a note of his or her name in his pocket-book, and sends it to the Oberförster. At the end of the month, the Oberförster prepares a list of all the forest offences of the month in a form of which I attach a specimen translated into English. This is sent to the Amtsrichter—a judge in small criminal cases, with powers similar to those of our magistrates—and contains full particulars as to the name of the offender, nature of the offence, etc., and the amount of the penalty proposed by the Oberförster, which is according to a scale laid down in the Act. In ordinary cases it is five times the value of the property stolen, with a minimum of one mark (one shilling). Under certain aggravating circumstances it may be doubled. These are:

(i) When the offence has been committed on a Sunday or public holiday, or by night.

(ii) When the offender has employed means to make himself unrecognizable.

(iii) If he has refused to give his name and address, or has given them wrongly, or if he has tried to escape after being hailed by a forest officer.

(iv) If he has made use of any sort of cutting instrument.

(v) If he has refused to give up his tools when required to do so.

(vi) If he is accompanied by a cart or any beast of burden.

(vii) If the property stolen consists of living plants.

(viii) If resin, sap, roots, or main shoots of living trees have been stolen.

(ix) When the theft has been committed within an enclosure.

The columns 2, 3, 5, and 6 of the form are filled in by the forest officer who detects the offence; column 7 by the Oberförster; and 8 containing the decision by the Court, which then serves a notice upon the accused parties, intimating that the penalties ordered will be executed, unless they appear within a certain date to show cause why the sentence should not be carried out. As a rule the accused acquiesces and pays the penalty; the facts are generally undeniable and the law explicit. It will be observed that no option is left even to the judge as to the amount of penalty to be inflicted, so the accused can have little object in defending himself; but if he likes he can state his objections to the Amtsrichter, who then decides according to his judgment. In the rarest cases he demands a regular trial; indeed, a formal prosecution for an ordinary forest offence is a thing almost unknown in Germany.

In addition to the fine of 5 (or 10) times the value, the offender can be sentenced to imprisonment up to six months :—

1.—When the theft has been committed by three or more persons together.

2.—When it has been committed with the intention of selling the material stolen.

3.—When forest thefts are carried on habitually, or as a trade.

Still more severe punishments, up to two years, are provided for habitual offenders, and besides the legal punishment, the value of the property stolen must be made good.

The above applies only to forest produce standing or growing in the forest. Offences against grazing rules are punished under another Act, but the procedure is equally summary.

The working of this simple and lenient procedure is excellent. It gives the forest officer all the power he really requires: whilst security against its abuse is provided by the intervention of a judicial Court between the prosecutor and the accused.

II and IV. Cattle-grazing and forest rights.

It will be convenient to treat these together.

Originally, it is supposed that the forests were all public property, belonging to the "Mark", or village community, every individual helping himself to wood, leaf-litter, and such other forest produce as he might require, and grazing his cattle just as he pleased. In the course of time, as forest produce came to have a marketable value, the more valuable portion came into the hands of the richer and more, powerful members of the community, who were often no other than the State itself. Thus the proprietorship of the wood, and eventually of the entire forest, came to vest in the State; less important rights, then considered as of too little value for anyone to trouble themselves much about, continued to be exercised by the individual members of the community. The principle rights still existing at the present day are:

(1) Rights to timber and fuel according to requirement.
(2) Rights to leaf-litter.
(3) Rights to dry wood.
(4) Rights to cattle-grazing.

There are many others, but rather of local than of general importance.

Special Acts provide for the compulsory extinction of every right, at the instance of either party. The procedure is extremely complicated, and varies very much in different States. I can only refer those who wish for complete information on the subject to the learned and exhaustive work of Danckelmann, quoted in the beginning of this report. All I can do here is to offer a few scattered remarks on each of the different rights which I have mentioned, and their importance from the point of view of forest administration.

(1) The right held by the people in so many districts, to be supplied from the Government forest with all their requirements of building timber and fuel is not in itself considered to be injurious to the forests, provided that they are able to meet the demands. But as it gives a good deal of trouble to forest officers and causes friction between them and the people, Government have almost everywhere decided to purchase it off, and in many districts the right is now extinct. The process was a very simple one; the value of the average yearly demand upon the forests being capitalized, and the amount paid over in a lump sum to the holders of the rights.

(2) The right to collect leaf-litter is one of the most injurious to the forests that exist. To clear away the dead-leaf carpet of a forest is to sap its very life, and in all parts of Germany I have met with forests which were vainly endeavouring to struggle against the ruthless tax which they had yearly to pay to the surrounding villages. It is considered better to buy the right off wherever it exists, even at a sacrifice, rather than let it continue, and in the small State of Anhalt-Dessau no less than 300,000 Marks (about £15,000) have been spent in extinguishing this disastrous right. Still, when practised under proper restrictions, *i.e.*, when the collection of litter is confined to pathways, open places and pits, it may be harmless, and as the privilege is of great value to the people, it has been frequently allowed under control, even where the right does not exist.

(3) The right of collecting dry wood may be rendered perfectly harmless by a very simple rule, which I trust I shall be pardoned for observing I have frequently brought to the notice of the Bombay Government. It is to allow no sort of cutting instrument to be used in collecting the wood. As long as nothing more is collected than what people can pick up from the ground, and dry twigs which they can break off with their hands, no great harm can be done to the forests. It is a privilege much prized by the poorer classes, and, subject to the restriction which I have mentioned, is generally permitted. In India it should be allowed everywhere.

(4) Cattle-grazing is not carried on in the Government forests in Germany to anything like the extent that it is in India; in fact it is generally restricted to mountain districts; only in certain localities,—Westphalia and Holstein—are extensive tracts of pasture land, such as are known in India under the name of *kurans*. Of course in India the cattle-population of the country is immensely increased by the religious scruples of the natives, and speaking roughly I should say that the number of horned cattle contained in an Indian village was on an average nearly ten times that in a German village of similar size and conditions. This of course places the grazing question in quite a different aspect in India and in Germany. In Germany, as in India, the cattle graze in the forests only during the summer months, and here when they do graze, they are practically dependent upon the forest pasture for their nourishment. Only when they have a long journey to make to reach the pasture, they get a small feed before starting. In India little milk or work could be expected from cattle which received no other nourishment than the miserable grass of the hillsides.

In former days, in Hanover, rights of grazing existed to such an extent that forest officers were unable to make enclosures round the young sowings and plantations. They had to plant out trees six or eight feet high, so that their heads should be out of reach of the cattle. Subsequently, however, a principle was applied, which is, I believe, a fundamental axiom of law in every country, namely, that no right can be allowed to exist to such an extent as to destroy the property from which it is derived, and accordingly the grazing was restricted, so as to admit of necessary enclosures being made. At the present day, in all Prussian provinces, up to one-fifth of the total area of the forest may be legally enclosed, and all the gentlemen with whom I have spoken on the subject agree that this proportion is quite sufficient, and that cattle-grazing does not under these circumstances injure the forests.

For many years the Government of the various German States have been engaged in purchasing off the right of grazing wherever it exists, and there seems to be a general feeling that they have gone a little too far. It is complained that in localities where the cattle have from immemorial time grazed in the forest, and more particularly where special breeds of hardy mountain cattle exist, they have deteriorated since the forest grazing has been stopped. One gentleman, Forstrath Reuss, who has given special attention to this subject, expressed himself very strongly indeed to me. He declared that at least 50 per cent. of the cattle were infected with tuberculosis, and he instanced some experiments which had been made with a view to testing the truth of this opinion, with the result that not one-half but *the whole* of the cattle examined were found infected. True, the animals appear to be in perfect health, but this is due to the fact that the germs of tuberculosis take a very long time, about ten years, to develop, and in Germany the cattle are generally slaughtered at an earlier age; still the taint is there, will be transmitted to the offspring, and will inevitably lead at last to a generally diseased condition of the cattle. This disastrous state of things he attributes entirely to the unhealthy conditions to which the cattle have been subjected since the abolition of grazing in the forests. The cattle, instead of the healthy life which they have always been accustomed to, with plenty of fresh air and exercise and the green pastures of the mountains for their nourishment, have been suddenly transferred to the close atmosphere of the stables, and fed upon the refuse of th sugar factories.

Similar opinions are, I believe, held by many competent authorities and grazing has in consequence been allowed to continue in some forests, even after the right has been extinguished. This is notably the case in the Hartz mountains. where a well-known breed of small and active cattle is maintained; these graze in the forests in much the same way as the cattle do in India, paying a fee for the season's grazing. The scale of fees in the Prussian Hartz is as follows:—

Cows and oxen	2	marks (or shillings) for the season.
Half-grown ditto	1½	ditto ditto.
Calves . .	1	mark.
Geese . .	5	Pfennigs (about ½*d*).

Where the number of cattle is so small, and forest subordinates honest, the control of the grazing is easy. All the cattle of the village are in the charge of a responsible cowherd, approved by the Oberförster, who may require his dismissal if he infringes forest rules. He is bound to keep a statement of the cattle on which fees have been paid, signed by the treasury officer, always with him, and the forest subordinate officials are required to count the cattle periodically, and compare the number with that shown in the treasury receipts.

With regard to the mode of assessing the amount of compensation to be paid for compulsorily extinguishing a forest right, there are two points of view from which the question may be approached.

1. That of the value of the right to its possessor, *i.e.*, the profit which he derives from its exercise.

2. That of the injury suffered by Government, or of the advantage to be gained by its extinction.

For example, it may be that a right of scraping resin in a spruce fir forest brings in a yearly profit of 10 marks, but causes damage to the forest to the extent of 100 marks a year: which is to be taken as the basis of the calculation for compensation? The principles which determine the answer to this question are extremely complicated. As a broad general rule it may be said that when the right is to be extinguished at the instance of the State, the compensation is regulated by the advantage which the holder of the right gains from its exercise; when on the other hand it is the holder of the right who desires its extinction, the State may choose whichever mode of assessment is to its own advantage, but this rule is complicated with various restrictions and exceptions in different States, and to deal with it exhaustively would require a treatise on German law.

3. The last question with which I have to deal is one of which the importance may not be apparent to every Indian forest officer. Many will remember the controversy called forth by the publication of Pressler's *Rationeller Waldwirth*, but will suppose it to have little beyond academic interest. This is not at all my opinion. The bitterness of the feeling which Pressler aroused was owing to the fact of his having told the German foresters that a fundamental mistake lay at the bottom of their working-plans, to rectify which would involve an entire remodelling of the plans, and above all, a considerable shortening of the period of rotation. It is now, when working-plans are gradually coming into existence for so many of the more valuable forests of India, that we ought to turn our attention to these questions and try to avoid the mistakes which have been made in Germany.

Although the theories of the modern school of forestry, as represented by Pressler, Heyer, Judeich and others are, by no means, confined to the fixing of the rotation, it is with this that I shall principally deal in this report. Originally, it was the custom to fix the rotation at the age at which trees were supposed to be "mature"; the question, what was meant by mature, would have called forth rather vague replies. But if our endeavour must be to satisfy, as far as is possible, the public demand of the market, and the measure of the demand for wood of various dimensions, is to be found in the price which consumers are willing to pay for it, the proposition resolves itself into this: we must grow wood of those dimensions, *i.e.*, choose that rotation which gives the best return on our capital; in other words, that which pays us the best. This is, speaking broadly and generally, the position of the Tharand School. The object which a sound system of forest management should hold in view is not so much to obtain the highest yearly returns from the forest property, but to secure the highest returns *with the smallest outlay of capital.* It is the percentage of the returns upon the amount of capital sunk which must be considered. Or again, that system is most advantageous which yields the highest rent of the soil. These two propositions are identical. To make this clear, by an example, let us suppose that a regulated teak forest of 6,000 acres is worked on a rotation of 60 years, so that every year 100 acres are cleared, yielding, let us say, a yearly income of ₨4,000. The standing value of the forest, supposing the ages of the trees to be fully regulated,—*i.e.*, that the forest contains an equal quantity of every age, from the oldest to the youngest,—would remain constant, the quantity removed every year in the clearings being exactly restored by the yearly increase. Let it be taken at ₨1,00,000. With a rotation of 100 years the value of the standing forest would be greater, partly owing to the greater mass of the growing stock, partly to the higher value of the larger wood. Let us assume its value now to be ₨1,50,000, and the net revenue realized from the 60 acres which are cleared every year, to be ₨5,000. Now, although the higher rotation yields a larger yearly return from the property, it involves a loss, inasmuch as it is only paying 3⅓ per cent. upon the capital, whereas, under the 60 years rotation, it paid 4 per cent.

Of course, before calculations of this kind can be made, we must possess full information concerning the laws of growth of various kinds of forest. This information is generally collected into the form of produce tables, giving, for each kind of wood and every class of soil (generally arranged in 5 classes of quality), the total mass of wood standing on the acre at consecutive ages, 10, 20, 30, 40, etc., up to, say, 150 years. Until these have been made, there can be no talk of scientific forestry. I am not aware that anything has been done towards collecting information of this kind as yet in Bombay, but I presume that other presidencies are more ahead. It cannot be said that forests are not yet sufficiently ordered for the construction of produce tables. Directly they have been surveyed and divided into compartments, the quantity of wood cleared away per acre at every felling should be systematically recorded. In a very few years sufficient materials would be collected to make tables for the more important kinds of wood. Of course I am only speaking of those districts where the forests are forests," and not broad acres of wilderness. As to the calculations themselves, I take it for granted that trained officers are able to carry out arithmetical processes similar to those taught in the middle forms of an English public school.

We learn from political economy that the value of the *soil* is the surplus which remains out of the profits after deducting all cost of production, including interest on capital, wages of supervision, etc. This value when calculated from the expected profits of the future, and reduced to its present value, I may call the *prospective* value of the soil. All the expected net returns of forests in the future are, according to the Tharand theory, to be regarded as an annuity recurring every n years—n being the rotation. These, when capitalized to the present time, and cleared of all charges for production and supervision—similarly capitalized—give the present prospective value of the soil (*Bodenerwartungswerth*). The calculation may be expressed in a formula:

$$H_n = \frac{C_n + T_a\, 1{\cdot}0p^{n-a} + T_b\, 1{\cdot}0p^{n-b} + \dots\dots\dots + T_q\, 1{\cdot}0p^{n-q} - l\, 1{\cdot}0p^n}{1{\cdot}0p^n - 1} + M - S$$

where: H_n = the prospective value (capitalized) with a rotation of n years.

C_n=the net produce of the clearing at the end of n years.

T_a, T_b, etc., are the produce of thinnings after $_a$, $_b$, etc., years.

l is the cost of sowing and planting out the forest.

M is the value of any minor produce which may be expected, capitalized to the present time.

S the cost of supervision and protection capitalized.

p the rate per cent. adopted as the basis of the calculation.

The notation 1·0p must be explained. It is the unit of interest, the amount to which one rupee will rise in one year at p per cent., *e.g.*, if p=5 per cent., 1·0p=1·05.

All the elements are expressed in terms of money.

Or the equivalent yearly *rent* of the forest may be calculated by the formula:

$$R_n = \frac{(C_n + T_a 1{\cdot}0p^{n-a} + T_b 1{\cdot}0p^{n-b} + \dots . + T_q 1{\cdot}0p^{n-q} - l 1{\cdot}0p^n) 0{\cdot}0p}{1{\cdot}0p^n - 1} + M - S$$

where M and S represent, respectively, the *yearly* value of minor produce and cost of supervision. Which of these two formulas is used is a matter of indifference; it will be seen at a glance that the second represents the simple interest on the first.

The Tharand theory asserts that that system of management and that rotation are the most profitable for which the above expression reaches its highest value.

I have already remarked that the peculiarity of this method lies in the fact of its taking into account the value of the capital sunk in the forest. A little consideration will therefore show that it will always lead to a lower rotation than a calculation which merely aims at securing the highest yearly returns—because with the lower rotation the capital sunk will be less, or what is the same thing, the returns will be quicker. When these views were first brought out by Pressler in his *Rationeller Waldwirth* in 1858, they produced no little consternation amongst the forest professors of his day. Up to that time a rotation of 120 years for beech forests had obtained everywhere, and no one had ever thought of doubting such a venerable tradition. The new calculations would bring the rotation down to about 70 years, and it was very rightly pointed out that the forests would be cut down when the trees were mere sticks, and such a thing as a good, sound, mature piece of timber would be unknown in the future. Of course, although Pressler himself was an extreme man, this was driving his theories to an extreme, never even intended by him: still it was an undeniable truth that no State could dare to introduce the new theories into practice, as the first effect of any such attempt would be to flood the market with enormous stores of large timber, which would remain on hand unsaleable.

When I was in training for the Indian service in 1870-72 the controversy may be said to have been at its height, and the name of Pressler was one scarcely to be mentioned among the orthodox. A few of the more thoughtful professors, such as Heyer in Münden and Judeich in Tharand, became partisans of the *soi-disant* "Rational" School, but these were the exception, and the majority rather gloried in never having taken a book of Pressler's into their hands. Since then every thing has changed, and I have on the whole found such a remarkable consensus of opinion that although I have conversed very fully on the subject with gentlemen of very different shades of opinion and holding various positions, both as teachers and executive officials, including the late Professor Pressler's own disciples and successors in Tharand, I have not been able to find any vital point on which they do not say substantially the same. All are now agreed that the service rendered by Pressler in insisting upon forest science—or at least the important branch of forest organization—being treated mathematically, is simply incalculable. But that a mathematical formula cannot be rigidly applied in practice, without careful consideration of the consequences and without the modifications required by the special circumstances of each individual case, is an axiom which I am sure would nowhere meet with more ready acknowledgment than in Tharand itself. The weak point of the new method undoubtedly lies in the uncertainty of the factors in which it is based. They are all to be expressed in money; that is to say, the quantity of the wood, etc., must be multiplied by the price. Who can say what the price of forest produce will be 50 or 100 years hence? Again the factor p—which plays such a prominent part in the formula and represents the average rate of interest of public securities—how is that to be determined? Pressler took it at first at 4 per cent.; now it might perhaps be 2¾ or 2½. It must, however, be added that there is a way of meeting these sources of uncertainty, namely, by always taking the rotation a little higher than that arrived at by calculation. It is reasonable to suppose that in the future the price of wood, particularly of large timber, will increase, and the rate of interest will be more likely to go down than up. Both these causes tend in the same direction, namely, to increase the rotation, and if this is always taken rather high—a safe proceeding from other considerations,—then even the unexpected happening will only lead to a certain loss of revenue and will not jeopardize the entire forest revenue, as it would if the rotation were fixed too low. The loss occasioned by fixing the rotation a little too high may be regarded as an insurance fund to meet unexpected changes in the future.

In practice the values of the different expressions in the formula are taken from ordinary interest and discount tables, so that the calculations are extremely simple, directly the produce tables are available. I will now give an example of the calculation from imaginary figures, merely to show the way in which it is made. Suppose the following table to show in the second column the number of cubic feet produced per acre in a teak forest when cleared at successive ages, and the third column the average price per cubic foot of the resulting material cleared of all cost of felling, etc. The next column will show the total net value of the clearing. The fifth gives the expected produce from thinnings.

Age.	Produce of clearing. c. ft. per acre.	Average price. per c. ft.	Value of the clearing. per acre.	Thinnings produce about
		Rs.	Rs.	Rs.
30	700	0·25	175	5
40	1,040	0·30	312	6
50	1,400	0·45	630	8
60	1,830	0·60	1,098	10
70	2,250	0·69	1,552	13
80	2,675	0·72	1,926	16
90	3,040	0·75	2,280	20
100	3,400	0 77	2,618	24
110	3,500	0·78	2,730	...

The cost of planting out the forest we will suppose to be R7·4 per acre; that of establishment and other superintendence R2·6 per acre yearly. Further, we will assume that for 5 years after every clearing, the grass in the young plantation may be expected to sell for R3 per annum annually. I will first make the calculation in detail for one year—the 70th. The rate of interest will be taken at 3 per cent. Here:

$O_n =$ . . . . . . $=1,552$

$T_{30} = 5$

$T_a \times 1{\cdot}0p^{n-a} = 5 \times (1{\cdot}03)^{40}$. $=16{\cdot}30$

$T_{40} = 6;\ T_b \times 1{\cdot}0p^{n-b}$ . . $=14{\cdot}58$

$T_{50} = 8;\ T_c \times 1{\cdot}0p^{n-c}$ . . $=14{\cdot}40$

$T_{60} = 10;\ T_d \times 1{\cdot}0p^{n-d}$ . . $=13{\cdot}43$

Sum . $=1,610{\cdot}71$

deduct:

$l = 7{\cdot}4;\ l \times 1{\cdot}0p^n = 7{\cdot}4 \times (1{\cdot}03)^{70}$. $=58{\cdot}60$

$1552{\cdot}11$ = value of numerator of the fraction.

divided by $(1{\cdot}03)^{70} - 1$ . . $=223{\cdot}5$ = value of the whole fraction.

M is the *capitalized* value of an annual rent of R3, beginning at once and lasting for 5 years, returning again for 5 years after every 70. This is obtained by the formula $\frac{1{\cdot}0p^5 - 1}{0{\cdot}4p \times 0{\cdot}0p^5} \times \frac{1}{1{\cdot}0p^{70} - 1}$, and is = 15·66.

S is the capitalized value of an annual rent of R2·6 = R86·56.

The value of the whole expression is therefore:—

$$\begin{array}{r} 223{\cdot}50 \\ +15{\cdot}66 \\ \hline 239{\cdot}16 \\ -86{\cdot}56 \\ \hline 152{\cdot}60 \end{array}$$

This is for H_{70}. That of r_{07} would be 4·57.

In the next table I have shown the value of H (which it will be remembered represents the capitalized value of the soil) for each rotation from 50 to 100 years.

	Rs.
50 years	116
60 "	147
70 "	153
80 "	123
90 "	102
100 "	76

It will be seen that the value is highest at the 70th year, which is, therefore, the rotation to be chosen. Did we wish to fix it so as to bring in the greatest yearly net revenue, independently of the capital engaged, it would be necessary to find the *mean annual increase* at each age, which is simply the expected produce (in rupees) divided by the age. The figures would then be thus:

60 years	18·3
70 „	22·1
80 „	24[illegible]
90 „	25·3
100 „	26·2
110 „	24·8

This culminates at the 100th year, after which it steadily diminishes; this is therefore the rotation sought.

The following extract from Professor Stölzer's *Waldwerthrechnung*, Frankfort, 1894, gives, I think, a fair idea of the attitude of the more thoughtful forest officers of the present day to this question:

> The author fully recognized the impossibility of *accurate* calculations in many cases, owing to the fact that the quantities involved in the formulas can only be determined with a *moderate* degree of accuracy, and because in judging of forest principles other questions than those of pure finance must be allowed to weigh. None the less is the author convinced of the importance, if only from an educational point of view, of an academical treatment of the theories of forest valuation and of forest statics. A thorough mastery of the logical structure of a science is not only a most effective means of enhancing the mental capacity, but enables many problems (choice of the forest to be grown, method of treatment, rotation and age of felling most favourable to the objects desired) to be viewed from a rational standpoint, that is, from one of logic and common sense. All arithmetical subtleties must be avoided, and the adaptability of the theories to practice never left out of sight.

I cannot close this report without a word of apology for the very sketchy and superficial style in which particularly the last two questions have been treated. It could not well have been otherwise. It would have been easy for me to swell this report to a volume, but I could only have repeated what has already been far better said by the German authorities, to whom I must therefore refer those of my readers who wish to study the subjects. Particularly in forest organization,—a branch in which, I think, we are a little backward in India,—I would strongly urge upon Government the advisability of having at least one of the standard works translated for the benefit of Indian forest officers. The work which I would recommend is Judeich's Forsteinrichtung, 5th edition, 1893, in which the results of the most recent thought on the subject are embodied. A work of this kind would be of the greatest value in India. All I can possibly hope to do in this report is to draw attention to the questions, and at least try to make it clear what they are.

A short reference to the financial system in force in Germany may be of interest. No forest officer ever touches Government money. A special forest treasury exists in every Oberförsterei, into which revenue is paid direct by the purchasers of forest produce. Payments of every kind are made by cheques on the treasury. I am quite aware of the difficulties which would be in the way of introducing this system into India—still it seems to give no trouble in Germany, where the treasuries are not more frequent than they are with us.

In years of dearth and scarcity, such as 1893, the German Governments generally concede the permission to graze cattle in the open forests, as far as I can understand, on payment of a small fee. I should add that, under no circumstances whatever, are goats allowed to graze in any Government forest.

I append a few forest statements in graphic form, for which I am indebted to Herr Oberforstrath Rausch. They show the progress of forest administration in the Duchy of Saxe-Coburg-Gotha during a series of years. I thought they would be interesting from the novel form in which the information is exhibited. It seems to me excellent; a map of this kind appealing more eloquently through the eye than a world of tabular statements could do. I have added an English translation of the headings, and the statements explain themselves. Each shows in a graphic way the fluctuations of different elements: quantity of wood felled—receipts—prices of wood—expenditure—area and cost of plantations. The two coloured sheets exhibit the area of standing forest of different ages, from ten to ten years—one is for 1880, the other for 1893. A remarkable feature is the enormous preponderance of the older age-classes, *i.e.*, of large timber, and a comparison of the two statements shows how much of this it has been possible to work off in thirteen years. In 1880, there were 5,280 of forest, of more than 90 years of age, or 2,280 more than the normal area of 3,000 acres. In 1893 this had been reduced to 5,020, or 2,020 in excess of the normal. Fortunately, there is a deficiency in the age-classes next below the oldest, which will enable them to go on drawing upon these old stocks; and when the trees planted in 1825-35 come to be felled, that is, in about 40 years from the present time, a very fairly regulated sequence of ages will have been attained.

It now only remains for me to express my appreciation of the civility and attention with which I have been met by the German forest officers in the course of my enquiries. Nothing could exceed the kindness with which I was received everywhere, and the utmost pains were taken to procure for me the information which I desired. I confess that I wish the day would return when Indian forest officers should be trained in Germany. All that is required is for an Englishman to reside in the country and have charge of the training. The system under proper conduct could not fail to be attended with satisfactory results.

GEORGE AINSLIE HIGHT.

WEIMAR.

23rd April 1894.

APPENDIX

(Specimen Form).

Specimen form for forest thefts submitted monthly

1	2	3	4			5	6
Number of case.	Letter for each accused.	Full name, description, residence and age of each of the accused persons.	PREVIOUS CONVICTIONS.			I.—Substance of accusation with circumstances entailing an enhancement of the sentence. II.—Names of witnesses. III.—List of property confiscated. IV.—Name of the person injured.	Value of stolen property.
			Date of offence.	Date of judgment.	Date of execution.		

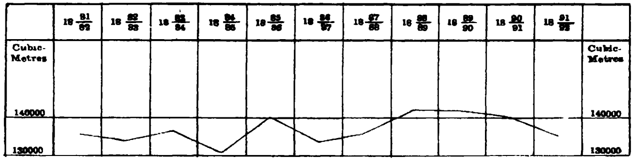
to the Court by the Oberförster (Prussia).

7						8							9	10		11
PENALTY PROPOSED BY THE PROSECUTOR.						JUDGMENT OF THE COURT.							Reference to record of judgment.	DISPOSED OF IN COURT OF FIRST INST.		REMARKS.
Act.	Time.	Imprisonment in default of punishment.	Detention.	Damages.	Confiscation.	Act.	Time.	Imprisonment in default of punishment.	Detention.	Damages.	Confiscation.	Damages payable to				

Government of India Central Printing Office.—No. 362 R. & A.—400.—3-11-94.—J. F.

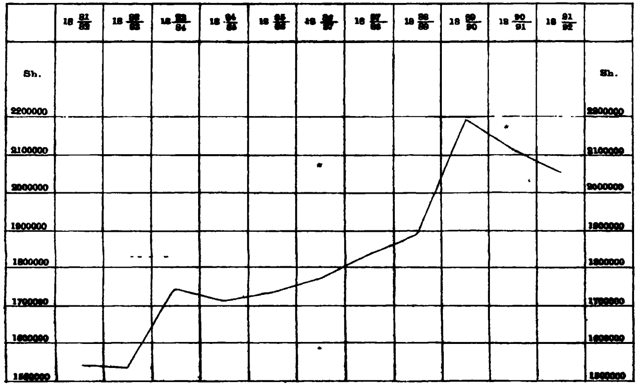
TABLES SHOWING THE PROGRESS OF FOREST CONSERVANCY IN THE DUCHY OF SAXE-COBURG-GOTHA DURING 11 YEARS.

TOTAL QUANTITY OF WOOD FELLED



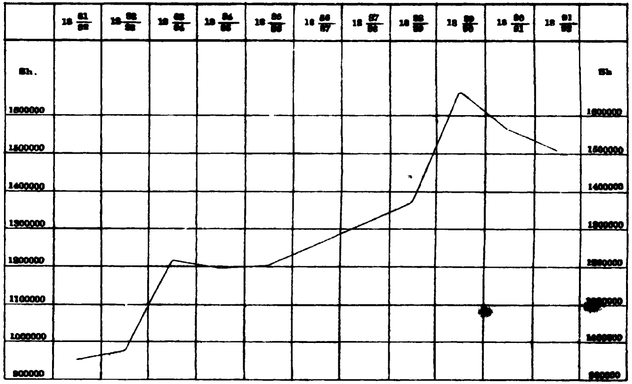
GROSS RECEIPTS IN MONEY

(A) TOTAL

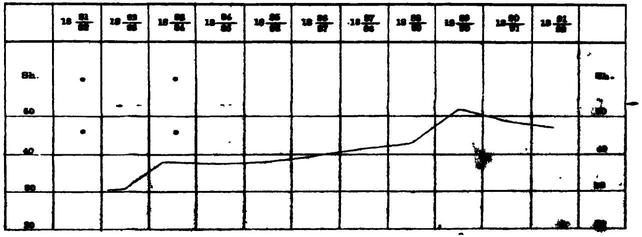


NET RECEIPTS IN MONEY

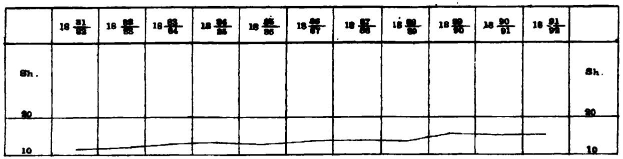
(A) TOTAL



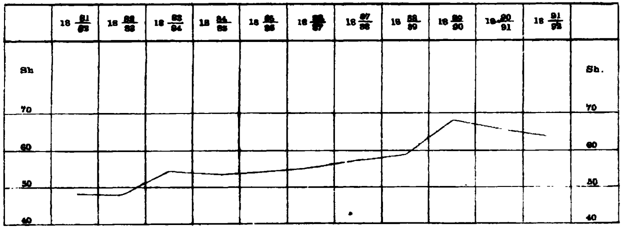
(B) PER HECTARE



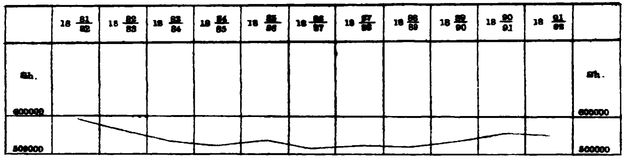
(B) RECEIPTS PER CUBIC METRE



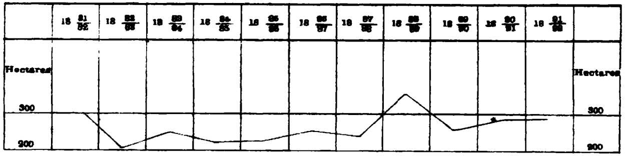
(C) RECEIPTS PER HECTARE OF AREA



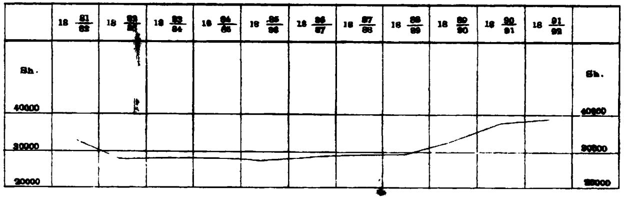
TOTAL EXPENDITURE



AREA PLANTED OUT



COST OF PLANTATIONS



Drawn in the Offices of the Imperial Forest Surveys W. H. Reynolds, Esq., F.R.G.S., Superintendent.

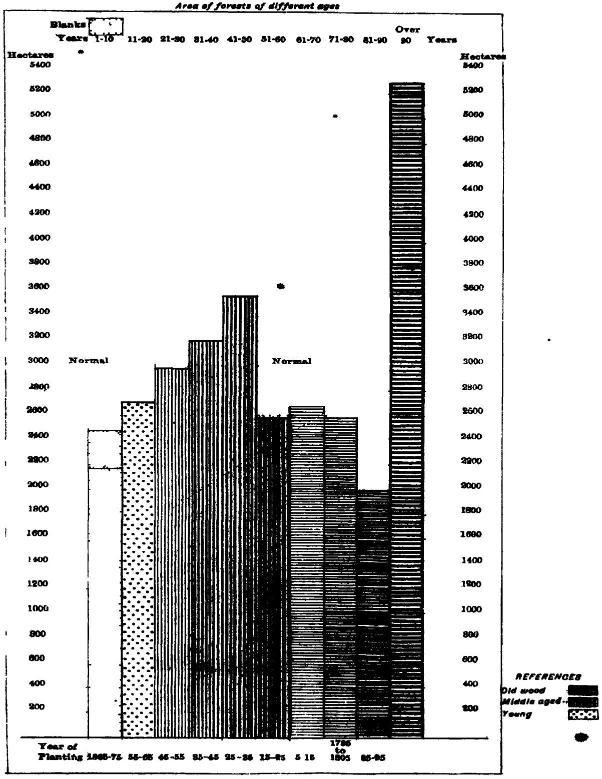
Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, October 1894.

For. - Oct. 94 - 506

1880

CONDITION OF THE FORESTS IN SAXE-COBURG-GOTHA

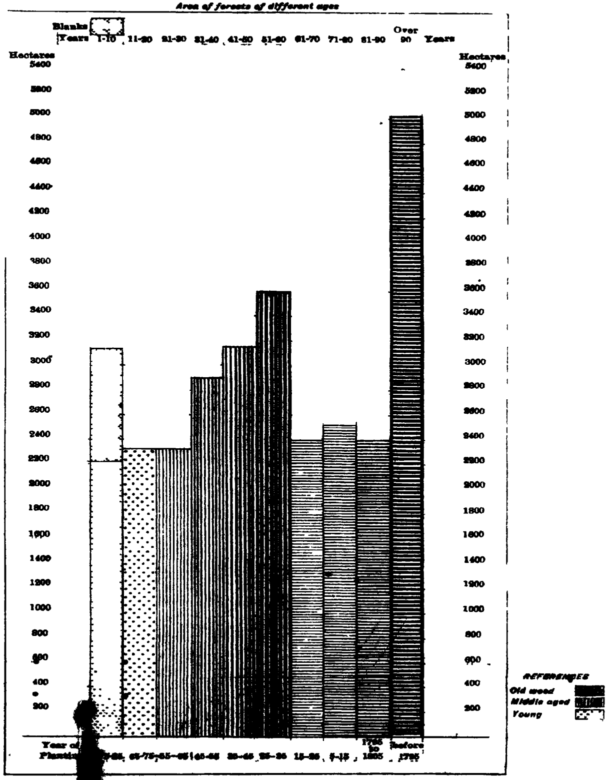
Area of forests of different ages



1893

CONDITION OF THE FORESTS IN SAXE-COBURG-GOTHA

Area of forests of different ages



For. - Oct. 94 - 505

Drawn in the Imperial Forest Survey Office, W. H. Reynolds, Esq., F.R.G.S., Superintend[illegible]tober 1894.

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra [illegible] October 1894.

APPENDIX SERIES

OF

THE INDIAN FORESTER.

CONTENTS.

PAGES.

Oil . . . . 1—2
Chemistry 3
Medicine 3
Report of the Leprosy Commission in India, 1890-91 . . . 4—5
Trade 5

CHAULMUGRA OIL.

In this handbook the article in the Dictionary of Economic Products by Dr. J. Murray has been reproduced with additions and modifications. The Leprosy Committee, in their recently issued Report, state that it seems that the action of Chaulmugra Oil in leprosy, though at the best palliative, is more marked than that of Garjan Oil, and that it is probable that a prolonged and regular use of this oil may, in some cases, arrest the progress of the disease, though for how long is still doubtful.

Gynocardia odorata, *R. Br.* ; *Fl. Br. Ind., I., 195* ; BIXINIÆ.

CHAULMUGRA OIL ; LUCRUBAU OR LUKRABO SEEDS.

Syn.—CHAULMOOGRA ODORATA, *Roxd.* ; CHILMORIA DODECANDRA, *Ham.*

Vern.—*Chálmúgra, chhalmugra, chavulmungri,* HIND. ; *Chaulmúgri, petarkura,* BENG. ; *Kadu,* NEPAL. *Túkung,* LEPCHA ; *Chaulmugra,* BOMB. ; *Tángpung,* MAGH. ; *Taliennoe,* SING. ; *Brinj-mográ,* PERS. ; *Ta-fáng-tsee,* CHINESE.

The tree (*Gynocardia odorata*) which yields Chaulmugra Oil, is a moderate-sized evergreen glabrous tree, readily known by the hard, round, fruits, which grow on the stem and main branches, and found from Sikkim and the Khásia Mountains, eastward to Chittagong, Rangoon and Tenasserim.

"The fruit, which ripens about the end of September, resembles a Brazil nut without the hard shell, and is so excessively unctuous that the oil can be expressed by hand. Though not particularly unpleasant either in taste or smell, no animal seems to care for it, and it can be gathered either as windfalls, or by sending people up to beat the branches. The tree is chiefly met with on light, porous soil, and seldom, if ever, on alluvial, so such ravines as have thrown out *churs* of mixed gravel, shingle, sand, limestone, and similar *débris* along the eastern mountain ranges, are pretty certain to contain the *Gynocardia.*" Eastern Country Produce. *Ind. Agriculturist, January 1893.*

OIL.

The seeds yield under the hydraulic press from 25 to 30 per cent. of oil, to ether 51·5 per cent.; the latter oil turns green with the sulphuric acid test. (*Dymock.*) Chaulmugra oil has long been known and used in India as a remedy far cutaneous diseases, and has lately become a drug of some importance in European practice. As obtained in the bazars, the oil is commonly very impure, and the means of detecting these impurities has formed the subject of careful investigation by Dr. Dymock. When pure, the expressed oil is clear, of a pale sherry colour, with the odour of *chaulmúgra,* and a sp. gr. of 0·9450 at 85° Fh. (29·4° C) and 0·9359 at 104° Fh.

(40°-C). On being kept for some time it throws down a granular white fatty deposit. The oil obtained by Dymock on boiling the powdered seeds in water, however, was of a golden sherry colour, and formed no deposit. From Dymock's experiments it would appear that genuine Chaulmugra oil shows two marked re-actions with sulphuric acid, twenty minims of the oil (either cold-drawn or obtained by means of heat) with one mimim of strong sulphuric acid giving first a brown, afterwards a rich olive-green colour. If cold-drawn, a tenacious reddish-brown resinous mass, which will not mix with the rest of the oil, forms round the drop of acid, while, if obtained by heat, no such re-action take splace. As it is of great importance that the oil for medicinal purposes should be pure, the following test, described by E. Heckel and F. Schlagdenhauffen, may also be shortly detailed: "They direct the oil to be mixed with an ethereal solution of ferric chloride, and the mixture to be evaporated until the oil becomes of a dirty green colour; it is then allowed to cool, and a few drops of sulphuric acid are added, which produce a fine greenish-blue colour. The colouring matter may be dissolved out by chloroform, with which it forms a dichroic solution like that of chlorophyll. This solution gives a deep absorption band extending from 40° to 70° of the scale (the sodium-ray coinciding with 50°). In proportion as the solution is diluted, the black band becomes fainter, until, with a very weak solution, only a narrow, very pale band can be seen, extending between 40° and 48° of the scale." (*Dymock, quoting from Journ. de Phar. et de Chim., April 1st, 1885.*)

The fruits of the Chaulmugra tree are brought to Calcutta chiefly from Chittagong, and as sold in the market, are of two kinds, *vis.*:—(1) mature fruits, with a brown kernel, rich in oil; (2) immature fruits, with a black kernel, containing a smaller proportion of oil of a dirty colour.

To extract the oil, the fruits are broken, and the kernels separated from the shells, dried in the sun, and partially pounded with a pestle and mortar (ukhli) such as is used up-country for husking rice and pulses. The broken kernels are then put inside canvas pads, such as are used in the extraction of castor-oil, and the oil is expressed with the aid of fire in a castor-oil mill. Sometimes the oil is expressed in a native oil-mill, but this is not generally done, as a considerable quantity of oil is left behind in the refuse. As a rule the oil is neither boiled nor refined, but it can be purified by boiling.

The oil is of two kinds, *vis.*, (1) clear, sparkling, of a bright straw colour; (2) muddy, and precipitating a sediment of earthy colour.

Clear Chaulmugra oil is said to be not so efficacious for medicinal purposes as the oil with sediment. A sample of the latter was sent to Mr. D. Hooper, Quinologist to the Government of Madras, who reported on it as follows:—"The temperature of the Nilgiris was sufficient to render the oil quite solid, so I could not see what the sediment was like. The whole of the little bottleful was filtered through paper in a hot oven, and there was left on the filter some dross consisting of portions of the seed and gummy matter, which probably emulsified the oil, and made it thick. The specific gravity was carefully taken, and agreed with that of Dymock's pure sample, and was a little above that examined by Moss. I turned some of the oil into soap with potash, and examined the fatty acids. By recrystallising several times from alcohol I found that the highest melting point reached was that of palmitic acid (62° C.). Stearic acid was therefore absent, and palmitic acid, or its glyceride palmitin, must have been the sediment of crystalline fat when the oil is allowed to stand in the plains. The amount of palmitic acid was very large, and, if there is a kind of oil which remains clear for any length of time, then the proportion of this acid could not be so great, or I should strongly suspect adulteration with some other oil. I do not think your sample was adulterated."

CHEMISTRY.

An exhaustive analysis of the oil by Mr. J. Moss, F. I. C., F. C. S. an account of which was read at the British Pharmaceutical Conference in 1879, shows that it has a decidedly acid reaction, that the melting point is 42° C., that it contains no alkaloid, and that its chief constituents are gynocardic acid, 11·7 per cent., palmitic acid, 63 per cent., hypogœic acid, 4 per cent., and cocinic acid, 2·3 per cent. These acids exist in combination with glyceryl as fats, and the two former in the free state as well. The acid burning taste of the oil is stated to be due to the first-mentioned acid. For a full account of the chemistry, and the processes employed in analysis, the reader is referred to the paper by Mr. Moss in the *Year Book of Pharmacy, 1879, 523—533.* Mr. Hooper has found in a sample of the oil as much as 97 per cent. of fatty acids, 22·88 per cent. of which existed in a free state. Strong alcohol dissolves a considerable quantity of the oil.

MEDICINE.

The SEEDS of this plant, and those of the nearly allied *Hydnŏcàrpus Wightiana*, have long been used in the East as a remedy for leprosy. Dymock states that in the *Makhzan-el-Adwiya* they are shortly noticed under the name of *chawul mungri*, and that their use in leprosy and other skin diseases is mentioned both as an internal and external remedy. In native practice of the present day the seeds and OIL are both largely employed, and are as a rule administered mixed with *ghi* (clarified butter). They are supposed to be alterative and tonic when taken internally, stimulant when applied externally. They are principally employed in the treatment of leprosy and other skin diseases.

In 1856 *chaulmugra* was brought to the notice of Europeans in India as a remedy for secondary syphilis; later it was described by Dr. R. Jones of Calcutta as an efficient alternative tonic in cases of phthisis and scrofula; and in 1868 it obtained a place amongst the official drugs of the *Pharmacopœia of India*. In that work it is recommended as an alterative tonic in cases of leprosy, scrofula, other skin diseases, and rheumatism, in doses of six grains of the powdered seed in pill three times daily, to be gradually increased till nausea is produced, or five to six drops of the oil, similarly increasing the quantity. Of late years the knowledge and use of the drug have spread to Europe, where it appears to be increasing in favour and reputation.

During the past ten or fifteen years it has been very favourably reported on in many medical publications, especially as a remedy for leprosy, psoriasis, eczema, scrofula, phthisis, lupus, marasmus, chronic rheumatism, and gout. The preparations most in repute in Europe are the pure oil, gynocardic acid (which is supposed to be the active constituent), gynocardate of magnesia, and an ointment prepared from the oil. The remedy is generally employed both externally and internally, and it has been recommended that patients taking the medicine should live generously, as a weakly and under-nourished person is said to be specially liable to the bad effects of the drug, *viz.*, loss of appetite, nausea, and intestinal irritation. The oil is best administered in capsules, and should be taken immediately after meals, gradually increasing the dose from 4 grains to 30, 40, or even 1 drachm, as recommended in the *Pharmacopœia of India*. The best form of ointment is one prepared with vaseline. Perhaps the most satisfactory and trustworthy results have been those obtained in the treatment of acute and chronic eczema, and other forms of skin disease.

REPORT OF THE LEPROSY COMMISSION IN INDIA, 1890-91.

"This oil has long been known in the East as a remedy for leprosy, but it is only of late years that it has attracted notice in Europe. Like Gurjan oil,* it is used both internally and externally.

"Of eight answers recorded by Dr. Watt (Dictionary of Economic Products) from medical men who had used Chaulmoogra oil in leprosy, four were favourable, two denied that any result was obtained, while two were neutral and expressed no opinion as to the value of the oil.

Dr. Vandyke Carter selected cases for treatment with Chaulmoogra oil, and arranged them as follows:—

(*a*) Young, fairly-nourished subjects with early disease. In them the result was decidedly beneficial.

(*b*) Confirmed, but not disabled lepers. The effect of the oil on these was moderately beneficial.

(*c*) Confirmed, disabled, or broken-down subjects. No result was obtained in these patients.

Dr. Carter goes on to say that the longer the oil is used the more favourable will the result be, both in degree and permanence. The good effect may last for three, four, or five years after prolonged use of the oil, but the disease is never eradicated even in the most suitable cases.

"Of the first 47 answers received by the Commission from asylums and stations in which Chaulmoogra oil had been used, 30 reported more or less relief after the use of the oil. In some the relief was very slight, while in others the disease was said to be arrested. In no case was a cure reported. From 12 stations the reports showed that there was no effect after Chaulmoogra treatment, while 5 answers did not express an opinion one-way or the other.

"Mr. Sakharam Arjun† who was in charge of the ward for incurables in the Jamsetjee Jeejeebhoy Hospital, Bombay, gives his opinion of the value of the Chaulmoogra oil as follows:—

"Under the prolonged and continuous use of this oil the progress of the disease is arrested, the skin becomes soft and supple, the discolourations vanish, the different morbid sensations leave the patient, the mental hebetude passes away, the impared sensibility is completely or partially restored, the ulcers heal and cicatrise, though ever prone to break out again, and the general nutrition of the tissues improves, patients crippled before being known to walk about unassisted and to gain in strength and weight.

"In the Trinidad Leper Asylum ‡ many of the more intelligent patients asked for Chaulmoogra oil of their own accord, and continued its use for several months.

"One man used the oil internally and externally for seven years. The tubercles disappeared from his face and extremities, and the anæsthesia was lessened.

"The fact that these lepers persevered in any plan of treatment is in itself strong presumptive evidence that they derived some benefit from the drug employed, for such patients soon tire of any systematic medication.

"The chief results obtained in eighteen cases were—

1. Increase of perspiration.
2. Decrease of tubercles.
3. Improved appetite and sense of well-being.

---

* See Handbooks of Commercial Products, No. 17.

† Report on Leprosy, 1873.

‡ Report on Trinidad Leper Asylum., 1889.

4. Increase of sensation.

5. Increased suppleness of skin, and lessening of pains in joints.

"A similar result was observed in a highly intelligent private patient who had taken Chaulmoogra capsules for six years, and who had also tried residence in Europe. At one time he took seventy-five drops of the oil a day. When last seen the face was clear, but there were one or two nodules in the lobes of the ears, and a few small redish patches on the thighs. The intervals between the tubercular outbreaks were much greater, and the patient was able to do a great deal of riding.

"From the above experiences derived from various sources it seems that the action of Chaulmoogra oil in leprosy, though at the best palliative, is nevertheless more marked than that of Gurjun oil. Indeed it is probable that a prolonged and a regular use of this oil may in some cases arrest the progress of the disease, though for how long must still be doubtful."

TRADE.

Chaulmoogra seeds generally sell in Calcutta at R5 to R7 per maund (82 lbs.). At the present time (July) the supply in the market is small, and the seeds are selling at R13 per maund. The supply comes into the market at the end of the rainy season. The oil sells at R60 to R70 per maund wholesale, and its retail price is R2-8 to R3 per pound. Dymock writes concerning Bombay that "the seeds come from Calcutta, and cost in Bombay about R15 per Bengal maund of 80 lb. The oil used in European hospitals in Madras is supplied by a contractor, who expresses the oil from seeds imported from Calcutta.

EDGAR THURSTON,

Offg. Reporter on Economic Products

to the Government of India.

G. I. C. P. O.—No. 122 R. & A. D.—11-9-93.—3,000.

[This product is described in Dr. Watt's Dictionary of Economic Products, Vol. III, D. 40—47.]

BLACKWOOD OR ROSEWOOD OF SOUTHERN INDIA.

(DALBERGIA LATIFOLIA.)

The object of this hand-book is to bring together the available information, mainly derived from a recent enquiry by the Indian Forest Department, with reference to a timber which is already known in the English timber market under the name of East Indian Rosewood, with a view to promoting the export thereof.

Dalbergia latifolia, the timber of which is known in the British timber market as East Indian Rosewood, is a deciduous tree belonging to the Natural Order Leguminosæ.

In his 'Forest Flora of North-West and Central India,' Brandis says that the tree is found in "the dry forests of South and Central India, frequently associated with Teak and Bamboo in Southern India, also in the evergreen forests, extending north to the Satpura range, Bundelkhand, and the Malwa plateau (Bassi in Meywar); also, in the Andamans, in lower Bengal, Behar, in Sikkim at the foot of the Himálaya, and (scarce and small) in the Baraitch and Gonda forests of Oudh, along the base of the hills.

"In South India and the Godávari forests (Ahiri) a large tree, 60 to 80 feet high, with an erect, but not generally straight or regular trunk to 20 feet girth. In North India a moderate-sized or small tree, numerous thick branches, spreading into a large shady crown . . . Coppices well, and propagates itself readily by self-sown seed. Easily raised from seed, but of slow growth, especially while young; five to nine rings per inch of radius.

"Sapwood large, whitish;* heartwood with an irregular outline, from deep nut-brown to blackish purple, with white or purplish veins and streaks of lighter colour, and small whitish specks; fine-grained, strong, and heavy. The average weight of seasoned Blackwood fluctuates between 50 and 54·68℔; the lower figure is that given by Skinner, and the higher is the result of Baker's experiments made with Malabar wood. In the Central Provinces list, however, the weight is given at 66℔. The average value of P ranges between 722 and 1,104, and may be taken at 950. Old trees are often hollow, and have ring-shakes. When fresh-sawn, the wood has an agreeable smell.

"In India the timber is much valued for furniture, and combs and a great variety of ornaments are made from it.

"It is largely used for yokes, cart-wheels, ploughs and other agricultural implements, knee timbers of boats, and for construction, and for spokes and fellies of gun-carriage wheels (*Brandis*); also for the handles of knives, kukris and other arms, and for sleepers" (*Gamble*).

---

* Sapwood yellow, small; heartwood extremely hard, dark purple, with black longitudinal streaks (Gamble, *Man. of Indian Timbers*).

The following reports were recently received from Forest officers, at the request of Mr. Ribbentrop, Inspector General of Forests, in connection with enquiries which were made in India concerning the sale of the timber in England:—

MADRAS PRESIDENCY.

Mr. J. S. Gamble, formerly Conservator of Forests in the Madras Presidency, supplied the following note:—

"The rate of £13-10 per ton, quoted in the 'Manual of Indian Timbers,' was for an exceptionally large piece, of handsome grain. But I believe that good Mysore or Wynád Blackwood would fetch £8 to £10 per ton any day, if sent in regular supplies, in good squares of sound wood, carefully seasoned.

"I used to be very sore at having to sell my Mudumalai and Benac Blackwood at 4 to 6 annas a cubic foot in the forest, knowing its value in Europe; and I contemplated arranging for departmental transit to the coast at Calicut or Tellicherry (cart to the Nilambur river down the Karkoor Ghât, or through Vayitri and then floating), but my transfer stopped my design.

"The timber on the Western Ghâts runs big. I have seen logs of 2 feet square (4 square feet) on the section and 20 feet long, and pieces in squares of 18 inches side are not uncommon.

"In these days of low exchange the trade in 'Rosewood' (as they must call it to make the dealers understand) ought to pay well, and I should not be surprised if the Australian market was even better than the British. It is just the question of the fashion. At one time, I remember, 'Rosewood' veneered furniture was the correct thing; at another it was 'Mahogany;' at another 'Bird's-eye Maple.' Then came in the American 'Black Walnut.' Now I suppose 'Padauk'* will have a run, but the fashion may easily go back to 'Rosewood.'

"The pieces need not always be very large. Clearly large logs of ordinary wood have the best sale, but good small logs of pretty figure would possibly be better, and the handsome 'Rosewood' of the Circars and Northern Bengal might pay to export."

The following information was supplied by the Conservator of Forests, Southern Circle, Madras:—

"The tree grows in the deciduous and semi-evergreen forests up to 4,000 feet in the districts of Canara, Malabar, Nilgiris, Coimbatore, Madura, and Tinnevelly. As it has been one of the most prized woods of this part, and is of slow growth, and very susceptible to fires, it does not now exist as ripe timber in any large quantities anywhere, but is only found as scattered trees, mostly in out-of-the-way and difficult places to get at. Where we have been successful with fire protection, there is a good show of young growth, and every promise of a large supply in future.

"In private forests the timber has been, or is being taken out, everywhere, and it is difficult to say what chance there is of a future yield from this source.

"In forests now under the control of the Forest Department, we have in Canara about 600 square miles, with the tree thinly distributed. In Malabar there are about 800 square miles tolerably well distributed, and it is from Malabar that this timber is at present almost entirely exported. On the Nilgiri hills about 250 square miles contain a fair quantity, chiefly on the Wynád plateau. In Coimbatore there are about 1,200 square miles, of which a quarter contains a fair quantity, and the remainder has a thin sprinkling. In Madura about 300 square miles have a very small quantity not sufficient for local consumption, and it has to be supplemented by imports from Travancore. In Tinnevelly there are about 300 square miles with the timber very thinly scattered, and little used, as it is obtained at less expense from the Travancore forests.

---

* See 'Hand-books of Commercial Products,' No. 1.

"The present selling prices are as follows :—

Canara (on the coast) . .	R35 to R75 per ton according to quality.
Malabar („ „) . .	R70 per ton.
Nilgiris	R20 per ton on the Wynád plateau ; but in out-of-the-way places it cannot be sold for even R10 per ton.
Coimbatore	About R30 per ton.
Madura	R30 to R45 per ton.
Tinnevelly	About R50 per ton.

"The quantity exported is reported to be *nil* in Canara, the Nilgiris, Coimbatore, Madura, and Tinnevelly.

"From Malabar alone have I returns of exports, and these show from the several ports—

770	tons in	1888.
887	„ „	1889.
953	„ „	1890.
383	„ „	1891.
645	„ „	1892.

"Since about 1885 a more active demand has sprung up for the wood from Malabar, and of the quantity exported in the last five years a little more than half (1,977 tons) goes to Bombay for furniture and carving (it is presumed that some of it is also transhipped for the home market), while Katywar (572 tons), Kutch (383 tons), Karachi (206 tons), London (110 tons), Havre (92 tons), and Hamburg (50 tons) mostly share the remainder.

"Though the prices have risen since 1890, the exports have not responded, thus pointing to an increasing scarcity of the wood.

"It is very difficult to estimate the quantity extracted. From forests under our control we only supply annually at present about—

20	tons from	Canara.
180	„ „	Malabar.
20	„ „	Nilgiris.
80	„ „	Coimbatore.
15	„ „	Madura.

"It may be roughly estimated that little or no private wood is cut in Coimbatore ; that the same as the above-mentioned quantity is cut in private lands of the Nilgiris ; twice as much as in Madura ; three times as much as in Canara ; and five times as much in Malabar ; or 1,325 tons in all.

"In Malabar the timber is large, and sells at sizes from 12 to 24 feet long, and from 3 to 6 feet in girth. In Canara and the Nilgiris the usual size is about 20 cubic feet ; in Coimbatore about 30 cubic feet. In Madura and Tinnevelly the wood is small, from 4 to 6 feet length and up to 3 to 5 feet in girth.

"The tree grows readily from seed and root-suckers, and when coppiced young, shoots freely. It prefers a stiff, black clay, containing lime. The sap takes up much lime, which it deposits in cavities caused by injuries, often to the extent of several pounds. The lime, added to the natural hardness of the wood, makes the sawing of the wood at times very difficult.

"Recently I saw 150 tons being shipped at Calicut for Havre (I think), and was told that the sea carriage was at the rate of 50 shillings a ton."

TRAVANCORE STATE.

"Blackwood is widely distributed through Travancore, but is nowhere abundant. It is found in the deciduous forest with an undergrowth of grass, but is more common, and thrives better, in open forest with an undergrowth of evergreen shrubs, bamboos, etc. Although found, in suitable situations, at all elevations between the sea level and 3,500 feet, it attains its greatest dimensions at about 1,000 feet, and here too the timber is said to be stronger and of a better colour.

"Blackwood seeds profusely, and its seeds are carried long distances by the wind, so that, in places not harried by fires, groves of small tree may be seen when no parent tree is visible. It also throws up shoots from the roots, and if we had a proper agency for preventing forest fires, this tree would become one of the commonest, as it is one of the most valuable in the State.

"The present price paid by the Bombay contractors is R19 per candy of 15⅝ cubic feet for logs over 15 inches quarter girth, and R17 for logs under that size. This is equivalent to about R1-2 per cubic foot. Locally, for timber of large dimensions, as much as R1-8 can be obtained for a limited quantity.

"Figures for the last ten years show an average of 401 logs containing 487 candies (7,610 cubic feet), sold each year. Of these an average of 302 logs, containing 440 candies (6,875 cubic feet) has been sold for export; but the quantity taken locally is gradually increasing, and is now about 70 logs a year. The timber exported goes chiefly to Bombay.

"Very little first class timber comes down, for, when the tree attains a diameter of more than 15 inches, it generally begins to decay. Large trees of 4 feet in diameter are occasionally met with, containing sound timber throughout, but this is generally in places where the grass fires have not caused heart-shake." (*T. F. Bourdillon.*)

BOMBAY PRESIDENCY.

The following note was supplied by Mr. MacGregor, Conservator of Forests, Southern Circle:—

"It is only quite recently that a demand for Blackwood for export has sprung up. It is not a tree that is much used locally (*i.e.*, in the Southern Circle) for building purposes, although its good qualities are well known. This neglect of the wood for building purposes may be, in a great measure, owing to the fact that, wherever Blackwood is plentiful, Teak is also plentiful, and partly because it is less easily cut up, and is heavier. The wood is heavy and unsuitable for floating down the numerous streams of the ghâts. A cubic foot of seasoned heart-wood weighs about 48lb according to Mr. Talbot.

"Blackwood does not occur gregariously; it is generally very scattered, associated with Teak, Albizzias, etc.; it is rarely found in evergreen jungle. It grows to a great age without becoming unsound, and attains very large dimensions, trees of a diameter of 2½ feet at breast-height being frequently met with, and it is the only species in the forests of the Southern Circle which can be compared with Teak as regards longevity and soundness at an advanced age. It is very difficult to determine the extreme age of Blackwood, but about 300 years appears to be the maximum age attained by it in the Bombay forests.

"Blackwood is irregularly distributed over all deciduous forests of Kanara and the western portions of Dharwar and Belgaum. A heavy rainfall appears to be necessary for the attainment of great age and size, but it thrives at any elevation from the sea-level to the highest hill ranges of the ghâts.

"Trees of large dimensions are now rarely met with beyond the limits of the northern, central, and southern divisions of Kanara. They are most numerous above ghâts, and more numerous in the northern division of Kanara than elsewhere.

"Until lately there has been but little demand for the wood for export in the southern division.

"Logs for export should not be less than 24 inches diameter, should have the sapwood removed, and be exported in the round. Their lengths should be not less than 15 feet, although logs of shorter lenghts are also saleable.

"Speaking roughly—it is impossible to make anything better than a rough estimate—the areas of the southern circle in which mature Blackwood occurs in quantities sufficient for the object now in view aggregate perhaps 700 square miles, but owing to the distance of many parts of the Reserves from the coast or railway, it would be necessary to deduct a considerable area from the above before arriving at the workable area, having regard to the present prices. I estimate 400 square miles as the probable limit of workable area at present.

"When the Government of Bombay contemplated the construction of a tram or railway from the Southern Mahratta Railway to Gund, in order to facilitate the exploitation of part of the forests of Supa in the northern division of Kanara, I was asked to make an estimate of the standing stock in that area. The sustained yield of Blackwood, of 6 feet girth or upwards at breast-height, on 181 square miles only of this area, I estimated to amount to not less than 1,805 tons of 50 cubic feet each, representing a net value at present rates of R40,000. But the area referred to was, it should be noted, probably the very best for Blackwood in the whole Circle. Experiments, with a view to ascertaining the quantity of Blackwood available annually, have not been made in other divisions of Kanara.

"The Forest Department does not sell Blackwood at the ports of export. Below the ghâts it is generally sold standing. The price realised there varies according to the quality of the wood and the situation of the jungles in which it is obtained from about R20 to R40 per ton net.

"The wood now goes to Europe, China, Calicut, Bombay, Broach, and other towns on the coast. That the wood goes south appears to indicate that the forests in Madras, Travancore, and Mysore, within paying distance of the coast, are becoming exhausted, or that they are unable to meet an increasing demand.

"Above the ghâts Blackwood logs are now being exported from the Hallial depôt to the port of Marmagâo. The price at the Hallial depôt is about R42 per ton on an average, and the cost of cutting and transport to the depôt may be taken at R20 per ton, leaving a profit of R22 per ton.

"Mr. Talbot reports that last year 185 tons were sold at Hallial for local consumption at R37 per ton; 112 tons of selected logs were sold at R44 for export to Europe; and 250 tons at R48 for export to Broach.

"Round logs, from which the sapwood has been removed, are most in request for export.

"I have great hopes that the export of Blackwood, now in its infancy, will quickly increase up to the limit of capability of the forests, always excepting portions of the southern and central divisions far from the railway or the coast. Quite recently two European merchants (Mr. Brown of Calicut, and Mr. Tainsh of Bombay) have been induced to take up contracts for the purchase of the timber, and, if they are successful in disposing of it at a profit in Europe, the trade is certain to expand rapidly."

In the following statement, showing the quantities sold during the last three years in the northern and central divisions of Kanara, together with the amounts realised, the prices shown for the central division are net, and those shown for the northern division are gross prices, the cost of exploitation being about R20 per ton of 50 cubic feet :—

Northern Division of Kanara.

Year.	Quantity.	Amount realised.			Average rate per ton of 50 cubic feet.		
	Cubic feet.	R	a.	p.	R	a.	p.
1890-91	5,013	2,912	14	2	29	0	10
1891-92	632	371	10	9	29	6	5
1892-93	3,748	2,490	3	9	33	3	6
Total .	9,393	5,774	12	8	30	11	10

Central Division of Kanara.

Year.	Quantity.	Amount realised.			Average rate per ton of 50 cubic feet.		
	Cubic feet.	R	a.	p.	R	a.	p.
1890-91	2,821	2,235	0	10	39	9	10
1891-92	..	...			...		
1892-93	...	...			...		
Total .	2,821	2,235	0	10	39	9	10

MYSORE STATE.

(a) Kadur District.

"Blackwood is found in this district over an area of about 80 square miles. It is of two kinds, *bile-bite* and *kari-bite*. The former is of a light rose colour, and the latter of a black colour.

"Local demand for this kind of wood is very small. It is not therefore collected in large quantities in any of the depôts here. But, on receipt of an application from Mr. Brown of Calicut (Malabar coast) two years ago, 365 logs (8,075 cubic feet) were prepared in Lakvalli forest, of which he purchased 69 logs (1,942 cubic feet) at retail rates varying from 14 annas (2nd class) to 1 rupee (1st class) per cubic foot at Birur, and exported the same to England. Another merchant purchased about 4,000 cubic feet of wood at auction sale, at an average rate of 10½ annas per cubic foot at Birur, which, I hear, he despatched to Madras for making furniture. There are still (January, 1893) 1,842 cubic feet in stock at the Lakhvalli depôt, but there is hardly any demand for them.

"The retail prices now prescribed are :—

Lakvalli depôt	1st class	13 annas per cubic foot.
	2nd ,,	11 ,, ,, ,, ,,
Tarikere depôt	1st ,,	15 ,, ,, ,, ,,
	2nd ,,	13 ,, ,, ,, ,,
Birur depôt	1st ,,	1 rupee ,, ,, ,,
	2nd ,,	14 annas ,, ,, ,,
Chikmagalur depôt	1st ,,	1 rupee ,, ,, ,,
	2nd ,,	14 annas ,, ,, ,,

"The size of logs available varies from 15 cubic feet to 50 cubic feet, but generally logs measuring more than 20 cubic feet, 1 square foot in section and 20 feet in length, are difficult to find in large numbers.

"From what Mr. Brown's agent told me, I learn that good prices are offered in England for large, straight, figury logs, free from sapwood, cracks, and hollows, and yielding planks not less than 18 inches in breadth, but that inferior logs will sell there

"The logs of the Mysore District are far superior to those of Kadur, but even there Mr. Brown's agent rejected more than two-thirds of the quantity collected, though the wood supplied was the best available in the forests. On these grounds I think that logs in the rough cannot be sold to advantage in England, but, if they are sawn into scantlings and planks, and seasoned well, there is a chance of selling with profit.

"The wood is very hard, and difficult to fell, saw, or work, on account of incrustations of lime between the grain, and does not season rapidly.

"Natural reproduction from seed is plentiful in the forests. It also coppices well, and throws root-suckers. Its growth is slow, especially when young, and it is calculated to take more than eighty years to attain 6 feet in girth. Trees measuring 50 to 60 feet to the first branch, and over 8 feet in girth, are available, though rarely, in the forests, but they are generally found on the banks of streams and in rather inaccessible localities." (*B. Ramaswami Iyer, Assistant Conservator of Forests.*)

(*b*) SHIMOGA DISTRICT.

"Blackwood is found here and there over an area of about 500 square miles in State and District forests. It is mostly found in thick forests mixed with other useful kinds. The quantity sold from the depôts during the last ten years is given in the following table :—

NAME OF DEPÔT.	QUANTITY.		Average rate per c. ft.		Amount.		
	No.	C. ft.	*a.*	*p.*	*R*	*a.*	*p.*
Shimoga	46	1,229¼	10	6	806	5	5
Kanabur	44	1,173⅝	9	6	697	15	9
Aynur	30	658¼	9	5	388	4	5

"The average quantity extracted and exported is 306 cubic feet. The size of the logs varies from 16 to 50 cubic feet." (*C. Naraina Rao, Assistant Conservator of Forests.*)

(*c*) MYSORE DISTRICT.

"The actual collections of Blackwood timber during the past three years from the different jungles of the district amounted to 7,638½ cubic feet, giving an average of 2,546 cubic feet a year. Of this quantity 2,937½ cubic feet were utilised in the Province for various purposes, and the balance outside the Province. It cannot be said for certain how much was actually exported to England; but Mr. Brown of Calicut purchased 1,428½ cubic feet in this district for export to England in 1890-91.

"The dimensions of the logs collected and disposed of varied from 9 to 22 feet in length and 4 to 6 feet in girth. The wood is being sold by retail sale at 12 to 15 annas per cubic foot.

"The timber is met with in all the jungles of the district, covering an area of about 278 square miles; but logs of big dimensions are found pretty abundantly only in the thick or *Malnad* jungles." (*Y. Sita Ramaiya, Assistant Conservator of Forests.*)

(*d*) HASSAN DISTRICT.

"A small quantity of Blackwood is only very occasionally brought to the depôts, as the forests of this district do not contain much of this timber, and what is collected is consumed locally." (*H. Moothappa, Sub-Assistant Conservator of Forests.*)

COORG.

Mr. F. Prevost, Deputy Conservator of Forests, reports as follows :—

"As a rule, the Blackwood logs exported from Coorg are 15 to 20 feet long, with an average girth of 5 to 6 feet.

"All the exported wood goes to Madras and Mysore, and is used in the manufacture of furniture.

"The Blackwood trees in Coorg are as a rule fine, healthy trees, with a fairly good length of bole, and give good sound timber.

"The depôt rate has been fixed at 11 annas per cubic foot, but, owing to want of competition at the quarterly timber sales, this price is never realised."

The following statement shows the quantity of Blackwood sold annually during the five years 1887 to 1892 :—

YEAR.	Quantity.	Sold.	Amount.
	Number of logs.	Cubic feet.	R
1887-88	134	3,203	1,706
1888-89	126	3,866	2,409
1889-90	90	2,361	1,360
1890 91	87	2,512	1,386
1891-92	62	1,830	1,211

The price of East Indian Rosewood in the London market during 1892 was £7 to £11 per ton from January to October, and £5 to £9 per ton during the remainder of the year.

In their report on the Timber Trade, 1892, Messrs. Churchill and Sim state ('*Wood Circular*') that "the import (of East Indian Rosewood), although heavier than in the previous year, was not very large, but, as the demand declined, prices became weaker, and some parcels of small sizes and poor character, which had to be cleared off by forced sales, realised low figures. Large good logs, although lower, did not suffer so much, and unsold stock is now moderate, but should not be increased until the demand increases."

EDGAR THURSTON,

Offg. Reporter on Economic Products
to the Government of India.

Government of India Central Printing Office.—No. 74 R. & A.—28-11-92.—3,000.—F. F. B.